PAGE'S WEEKLY.—July 14, 1905. Thin Paper Copy for Circulation Abroad.

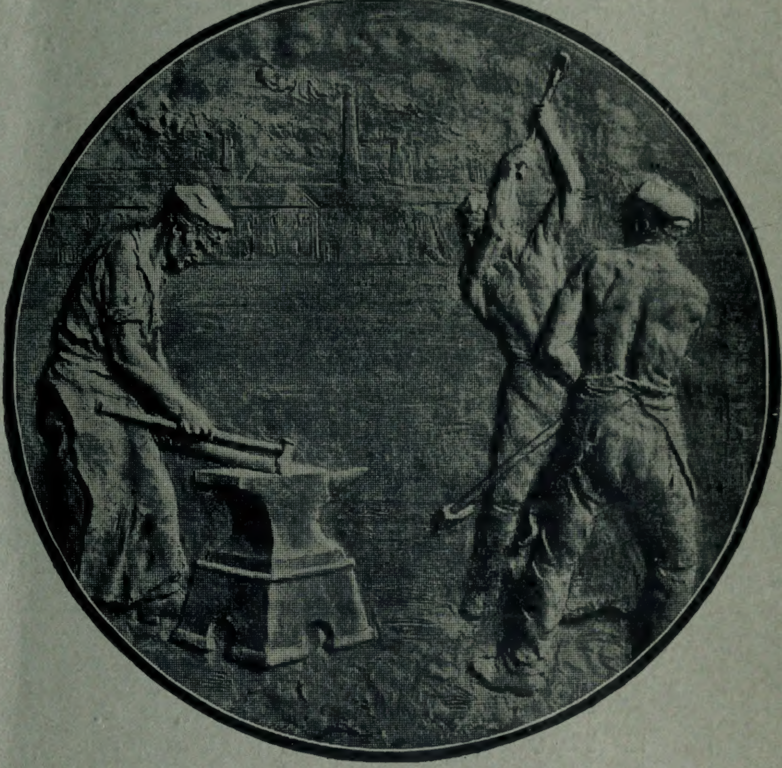
No. 44. Vol. 7.

SIXPENCE.
(Registered as a Newspaper.)

FRIDAY,
JULY 14, 1905.

PAGE'S WEEKLY

LIBRARY
AUG 1 1905
UNIVERSITY OF TORONTO



ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

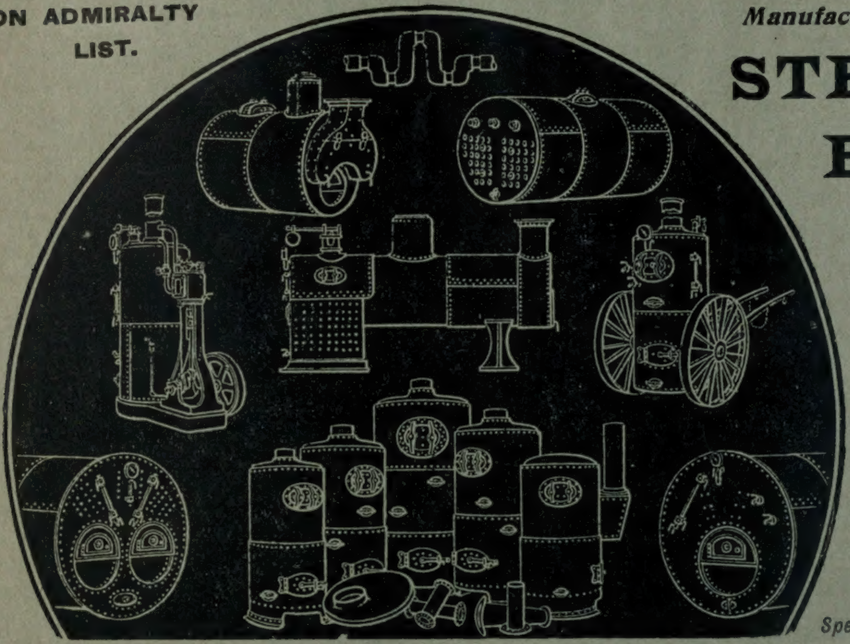
France, Paris : 22, Rue de la Banque.
Germany, Berlin : 13, Unter den Linden.
Russia, St. Petersburg : 14, Nevsky Prospect.
Italy, Rome : 307 Corso.
Austria, Vienna : Kärntnerstrasse, nr. 30.

India, Calcutta : Thacker, Spink & Co.
„ Bombay : Thacker & Co., Ltd.
South Africa, Cape Town : Gordon & Gotch.
Japan. Yokohama : Kelly & Walsh, Ltd.
New Zealand : Gordon & Gotch, Ltd.

Canada : Montreal News Company.
United States, New York : International News Co.
„ Chicago : Subscription News Co.
Australia, Melbourne : Gordon & Gotch.
Straits Settlements, Singapore : Kelly & Walsh, Ltd.

The Grantham Crank and Iron Co., Ltd., Grantham,

ON ADMIRALTY LIST.



Manufacturers of all kinds of

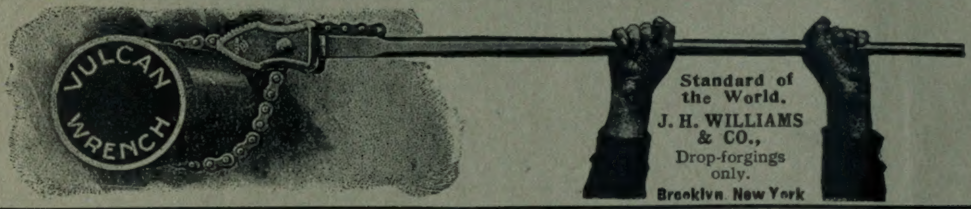
STEAM BOILERS,

Vertical Cross-tube, Multitubular, Portable, Loco. Type, Cornish, "Field" Tube, Launch, and "Colonial" Boilers;

ALSO MAKERS OF

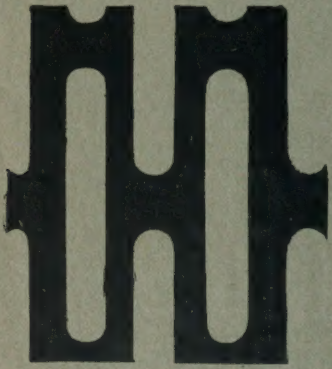
Vertical Steam Engines, Feed-Water Heaters, and Bent Cranks.

Special Terms to Shippers and the Trade.



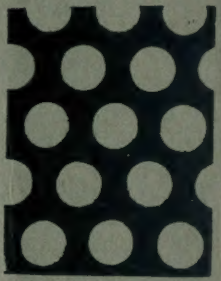
Standard of the World.
J. H. WILLIAMS & CO.,
Drop-forgings only.
Brooklyn, New York

PERFORATED METALS OF ALL KINDS.



MAKERS OF . . .

Filter Press Plates.
Rotary Sifting Plates, etc., etc.
Revolving Screens and Trommels, Black and Galvanized.
Embossed Plates for Stair Treads and Locomotive Steps.
Special Designs of Perforated Plates made exactly to drawings and up to one inch thick.



Telephone: 8168 BANK

ANDREW BROWN & Co., 110, CANNON STREET, E.C.

Sole Agents for FR. MEGUIN & CO., Ltd. Illustrated Catalogue Free. *Telegraphic Address*: "BROWPOST, LONDON."

PAGE'S WEEKLY Miscellaneous

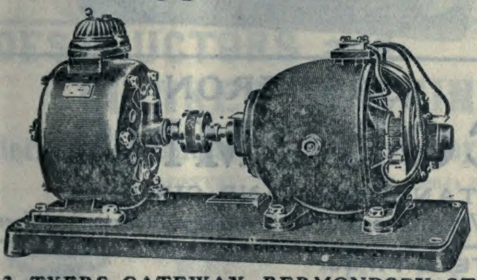
Mr. G. H. HUGHES, M.I.Mech.E.,
Consulting and Organising Engineer for Water Works and Industrial Undertakings,
97, QUEEN VICTORIA ST., LONDON, E.C.
Telephone No.: 5754 Bank. Write for particulars.

McINNES PATTERN.

HIGH SPEED INDICATORS.
Hannan & Buchanan,
75, Robertson Street, Glasgow.
ENGINE COUNTERS.
BOURDON GAUGES.
On Admiralty List.
Engineering Instrument Makers

RIVETS, BOLTS, & SCREWS
Of all Descriptions and for all Purposes.
SEND FOR CATALOGUE.
T. D. ROBINSON & CO., Ltd.,
DERBY.

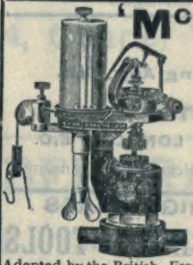
The Crypto Electrical Co.



ALTERNATING TRANSFORMERS
3, TYERS GATEWAY, BERMONDSEY STREET, LONDON, S.E.

THE ACME WATER STORAGE and CONSTRUCTION CO., Ltd.,
Patented March 9th, 1897. U.S.A.
Water stored where most convenient under pressure and automatically distributed.
For Town and Village Supplies, Suburban Establishments, High Buildings, Factory Sprinklers, etc.
Descriptive Circular sent on request.
ERIC S. A. SMITH, Water Supply Engineer, BRIDLINGTON.
Licensee, Sole Agent, and Manufacturer for the United Kingdom and Colonies.

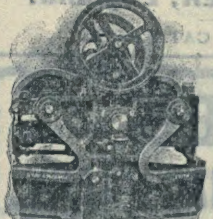
PAGE & ROWLINGSON,
Chartered Patent Agents.
Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*
28, NEW BRIDGE STREET, LONDON, E.C.,
And 14, St. Ann's Square, Manchester.



Adopted by the British, French, and Japanese Admiralties.

'McINNES-DOBBIE' INDICATORS.
In Two types: External and Enclosed Pressure Springs.
Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.
DOBBIE, McINNES, LIMITED,
45, BOTHWELL ST., GLASGOW.

WAYGOOD LIFTS
APPLY FOR CATALOGUE.
FALMOUTH ROAD, LONDON, S.E.



PUNCHING & SHEARING Machines.
STEAM HAMMERS.
Shipbuilders' MACHINE TOOLS.
DAVIS & PRIMROSE,
Leith Ironworks, EDINBURGH.

BABCOCK & WILCOX, Ltd.
PATENT WATER-TUBE BOILERS.
These Boilers are in use throughout the world to the extent of 4,700,000 h.p. generating steam for all purposes, and fired with all kinds of fuel.
See our Advertisement appearing Aug. 4th, page 37.
HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
WORKS—Renfrew, SCOTLAND.

GRAHAM, MORTON & Co., LTD.
Head Office and Works, LEEDS.
Makers and Erectors of all Classes of
CONVEYING PLANTS, COAL HANDLING PLANTS, AERIAL ROPEWAYS, &c., &c.

ENGINEERING PHOTOGRAPHY
Price List on application to—
BOOKER & SULLIVAN,
67 and 69, Chancery Lane, Telephone: 9252 Central. LONDON, W.C.

PAGE'S WEEKLY Miscellaneous

HARTLEY & SUGDEN, LIMITED, HALIFAX. TRADE MARK H & S Hx

Heating Apparatus

BOILERS

Wrot Welded Iron and Cast Iron Sectional

VERTICAL STEAM BOILERS

Apply for Catalogue.

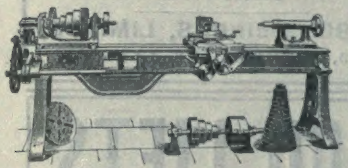
TRANSPORTERS.

See our Advertisement appearing Aug. 4th.

TEMPERLEY TRANSPORTER CO.,

72, Bishopsgate Street Within, LONDON, E.C.

Telephone: 365 London Wall. Telegrams: "Transumo."



HIGH-CLASS

MACHINE TOOLS

In stock for immediate delivery.

THOS. W. WARD, LD.

Albion Works,

SHEFFIELD.

STONE BREAKERS,

GRAVEL WASHERS, ETC.

SAMUEL PEGG & SONS, Engineers,

LEICESTER, England.

SEND FOR ILLUSTRATED CATALOGUE.

FORTUNES IN WASTE

FIREWOOD AND FIRELIGHTER **MACHINERY.**

M. GLOVER & CO., Patentees, LEEDS.

J. TOMEY & SON'S EUREKA GAUGE GLASS

ESTABLISHED 1853

ASTON. BIRMINGHAM.

A NEW GAUGE GLASS.

Samples, Lists, and Testimonials on application.

"S.H.P."

Tested to 350lb. Steam Pressure.

For High Pressure Boilers.

BRETT'S PATENT LIFTER Co., LTD.

COVENTRY, ENG.

Speciality—

FORGING PLANT.

See our Advertisement appearing Aug. 4th.

SEND FOR LATEST CATALOGUE.

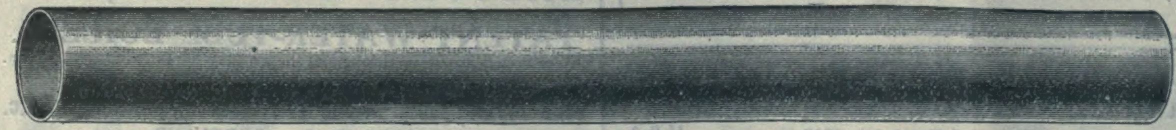
CAST-IRON

COLUMNS,

STANCHIONS AND GIRDERS.

Head, Wrightson & Co., Thornaby, Stockton-on-Tees.

WELDED AND RIVETED STEEL PIPES.



THOMAS PIGGOTT & CO., LTD., SPRING HILL, BIRMINGHAM. Send for Catalogue.

SHONE PNEUMATIC EJECTORS

FOR RAISING SEWAGE, SLUDGE, WATER, &c.

Air Compressing Machinery

FOR ALL SERVICES.

HUGHES & LANCASTER

47, VICTORIA STREET, LONDON, S.W.

WALTER SCOTT, LTD., LEEDS STEEL WORKS, LEEDS, ENGLAND.

MANUFACTURERS OF . . .

Rolled Steel Joists, Channels, etc.

Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds and Flats.

Speciality: **TRAMRAILS.**

Rochester Card
Bundy Key
Signature
Journey
Speed

RECORDERS.

For further particulars . . of our . .

TIME RECORDERS

see our whole page Ad. on Aug. 4th.

RECORDERS, LTD., 171, Queen Victoria Street, LONDON, E.C.

PAGE'S WEEKLY Miscellaneous

"ZECO" Brand.

Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.

ZEITZ & Co., 21, Lime St., London, E.C.

HIGH-CLASS NON-CORROSIVE

LUBRICATING OILS AND SOLIDIFIED LUBRICANTS.

(Castor, Lard, Olive, Neatsfoot, and Linseed Oils, Tallow, &c.)

RELIANCE LUBRICATING OIL CO.,
19 & 20, Water Lane, Great Tower Street.
LONDON, E.C.
Also at GLASGOW, HULL, BRISTOL, AND NEWCASTE-ON-TYNE.

MALLEABLE IRON & STEEL CASTINGS FOR ENGINEERS & TOOL MAKERS
TO MACHINE CLEAN & BRIGHT ALL OVER.
PARKER FOUNDRY CO. DERBY
ON ADMIRALTY LIST.

DESTRUCTORS and CLINKER MACHINERY.

Horsfall Destructor Co., Ltd., Armley, Leeds.

Telegrams: "DESTRUCTOR." Telephone: 2006.
Codes: A.B.C. (5th Edition) and Leiber's.

Refuse Destructors.

Write for particulars to:—

HEENAN & FROUDE, LIMITED
4, Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.

BERTRAMS, Ltd.,
Sciennes, EDINBURGH.
MACHINE TOOLS.

See Next Week.

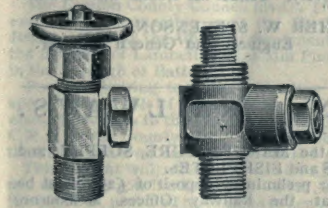
"CAMPBELL"
GAS ENGINES & SUCTION PLANTS, OIL ENGINES & PUMPS.

SOLE MAKERS—

THE CAMPBELL GAS ENGINE CO., *Limited,*
Halifax, England.

London Office—
114, Tooley Street, S.E.

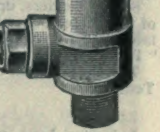
Glasgow Office—
104, Bath Street.



The
Scotch & Irish Oxygen Co., Ltd.,
ROSEHILL WORKS, GLASGOW.

Valves for Gas Bottles, Refrigerating Plant, etc., in Bronze, Steel, and Aluminium.

Reducing Valves, Keys, and all Fittings for Compressed Gases.



EDGAR ALLEN & CO., Limited,
Sheffield.

TRAMWAY MATERIAL.
IN ALLEN'S
IMPERIAL
MANGANESE STEEL.

PAGE'S WEEKLY Contracts

CONTRACTS.

CORPORATION OF LEICESTER.

WATERWORKS.

DERWENT SUPPLY MAIN, SECTION No. 1.
CONTRACT No. 2.

TO PIPE FOUNDERS.

The Water Committee of the Leicester Corporation are prepared to receive TENDERS for the SUPPLY and DELIVERY of PIPES and SPECIALS required in connection with Section No. 1 of the Main for bringing the Derwent Supply to Leicester, and for the Blackbrook Temporary Supply, comprising :—

	Tons	cwts.	qrs.	lbs.
32¾ in. Straight Socket Pipes ...	339	0	1	14
32½ in. do. do. ...	2573	7	2	0
32¼ in. do. do. ...	633	12	0	0
15 in. do. do. ...	82	7	0	0
12 in. do. do. ...	210	19	3	7
6 in. do. do. ...	9	7	2	0
Special Castings	163	17	2	16
Total ...	4012	11	3	9

The Drawings may be inspected at the Offices of the Engineer, Mr. J. B. EVERARD, M.Inst.C.E., 6, Millstone Lane, Leicester, and Conditions of Contract, Specification, Quantities, and Form of Tender, obtained from him upon payment of £5, which will be returned upon receipt of a *bona fide* Tender, and on the Conditions, Specification, and Priced Quantities.

Sealed Tenders upon the form supplied, addressed to the Chairman of the Water Committee, Town Hall, Leicester, are to be delivered not later than ten o'clock in the forenoon of Monday, the 17th day of July, 1905, endorsed "Tender for Pipes—Derwent Main."

The Corporation do not bind themselves to accept the lowest or any Tender.

E. V. HILEY,
June, 1905. Town Clerk, Leicester.

CORPORATION OF LEICESTER.

WATERWORKS.

DERWENT SUPPLY MAIN, SECTION No. 1,
CONTRACT No 3.

TO VALVE MAKERS.

The Water Committee of the Leicester Corporation are prepared to receive TENDERS for the SUPPLY and DELIVERY of No. 30 SLUICE VALVES, varying in size from 4 in. to 30 in. diameter, and No. 22 AIR, REFLUX, FLAP, and RELIEF VALVES required in connection with Section No. 1 of the Main for bringing the Derwent Supply to Leicester, and for the Blackbrook Temporary Supply.

The Drawings may be inspected at the Offices of the Engineer, Mr. J. B. EVERARD, M.Inst.C.E., 6, Millstone Lane, Leicester, and Conditions of Contract, Specification, Quantities, and Form of Tender obtained from him upon payment of £5, which will be returned upon the receipt of a *bona fide* Tender and of the Conditions, Specification, and Priced Quantities.

Sealed Tenders, upon the form supplied, addressed to the Chairman of the Water Committee, Town Hall, Leicester, are to be delivered not later than 10 o'clock in the forenoon of Monday, July 17th, 1905, endorsed "Tender for Valves—Derwent Main."

The Corporation do not bind themselves to accept the lowest or any Tender.

E. V. HILEY,
Town Clerk.

Leicester, June, 1905.

MERTHYR TYDFIL URBAN DISTRICT COUNCIL.

REFUSE DESTRUCTOR PLANT.

The Council invite TENDERS from experienced makers of Refuse Destructor Plant for the ERECTION of PLANT capable of effectually burning 120 tons of refuse per day, together with all buildings and contingent works connected therewith.

The Council have selected three alternative sites, and copies of the site plans, together with "General Conditions and Particulars for the guidance of Contractors tendering," may be obtained upon application to T. FLETCHER HARVEY, Esq., Engineer and Surveyor to the Council, upon payment of a fee of £3 3s., which will be returned upon receipt of a *bona fide* Tender.

The Council do not bind themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Destructor Plant," must be delivered to T. Aneuryn Rees, Esq., Clerk to the Council, on or before September 1st, 1905.

T. FLETCHER HARVEY,
Engineer and Surveyor to the Council.

Town Hall, Merthyr Tydfil,
June 16th, 1905.

CORPORATION OF DUBLIN.

TENDERS FOR ELECTRIC LOCOMOTIVES, ELECTRIC TRACTION MAINS, TRAMWAY TRACKS, OVERHEAD WIRES AND STREET POSTS, ELECTRIC AND STEAM CAPSTANS, &c., &c.

The CLEANSING COMMITTEE of the Corporation of the City of Dublin are prepared to receive TENDERS for the SUPPLY of THREE ELECTRIC LOCOMOTIVES for haulage of Refuse Wagons on the City Tramways; nearly 1,000 yards run of STREET TRAM TRACKS and ELECTRICITY MAINS, OVERHEAD TROLLEY WIRES, with STREET POSTS and CONNECTIONS; TWO ELECTRIC and ONE STEAM CAPSTAN, &c.

Specification, with Terms and Conditions, and Form of Tender may be inspected at the Office of the City Engineer, Mr. SPENCER HARTY, M.I.C.E.I., City Hall, Dublin, on and after Friday, July 7th, 1905, and may be obtained from him on payment of £1 1s., which sum will be refunded on the return of the Specification filled up with a *bonâ fide* Tender.

Tenders, sealed and endorsed, must be addressed to the Chairman, Cleansing Committee, 3, Cork Hill, Dublin, and delivered not later than 12 o'clock noon on Tuesday, July 25th, 1905.

The Committee do not bind themselves to accept the lowest or any Tender.

FRED J. ALLAN,
Secretary.

Cleansing Committee's Offices, 3, Cork Hill, Dublin.

TO IRONFOUNDERS AND ROOF CONTRACTORS.

THE GAS COMMITTEE OF THE COVENTRY CORPORATION INVITE

TENDERS FOR THE SUPPLY AND ERECTION of the following WORK :—

SPECIFICATION No. 21.—STEEL ROOFS with supporting Cast-iron Columns, and covered with Corrugated Sheeting for an Oxide and Lime Shed, 172 ft. by 62 ft. 6 in., and Coke Shed, 50 ft. by 30 ft. Also STEEL ROOFS for the following buildings: Generator House, 46 ft. 9 in. by 46 ft. 9 in.; Boiler House, 34 ft. 6 in. by 45 ft. 3 in., and Exhauster House, 32 ft. by 45 ft. 3 in. Also STEEL JOIST FLOOR, 33 ft. 9 in. by 12 ft. 6 in.

Approximate total weight of material, 182 tons.

SPECIFICATION No. 22—CAST-IRON ELEVATED WATER TANK, 17 ft. by 32 ft., with Girders to support same; CAST-IRON STAIRCASE and CHIMNEY CAP.

Total weight of material, about 43 tons.

Copies of Form of Tender, with Specifications, Bills of Quantities, and blue prints of Drawings, may be obtained on application to the undersigned, and on payment of 30s. in respect of Specification No. 21, and 15s. in respect of Specification No. 22. These payments will not be returned.

The Committee do not bind themselves to accept the lowest or any Tender.

Tenders must be delivered not later than first post July 17th, 1905, and addressed to the Chairman of the Gas Committee, Gas Works, Coventry, and endorsed respectively, "Tender for Roofs" and "Tender for Cast-iron Water Tanks, &c."

FLETCHER W. STEVENSON,
Engineer and General Manager.

Gas Works, Coventry,
July 1st, 1905.

VICTORIAN RAILWAYS.

TENDERS are invited for the MANUFACTURE, SUPPLY, and DELIVERY of STEEL RAILS and FISHPLATES.

Tenders, accompanied by the preliminary deposit of £250, must be lodged in the tender box at the Railway Offices, Melbourne, Victoria, Australia, or at the Office of the AGENT-GENERAL FOR VICTORIA, 142, Queen Victoria Street, London, E.C., before 1 p.m., Monday, the 7th August.

Specifications and Drawings will be available at the Agent-General's Office on the 18th June.

EAST INDIAN RAILWAY.

The East Indian Railway Company is prepared to receive

TENDERS FOR THE SUPPLY AND DELIVERY of :—

MILD STEEL PLATES, BARS, &c.,

as per Specification to be seen at the Company's Offices.

Tenders are to be sent to the undersigned, marked "Tender for Mild Steel Plates, Bars, &c.," not later than Twelve o'clock Noon on Wednesday, the 19th day of July instant.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each Specification a fee of £1 1s. is charged, which cannot under any circumstances be returned.

By Order, C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.,
July 6th, 1905.

PAGE'S WEEKLY Contracts

METROPOLITAN BOROUGH OF SHOREDITCH.

ELECTRICITY SUPPLY DEPARTMENT.

The MAYOR, ALDERMEN, and COUNCILLORS of the Metropolitan Borough of Shoreditch require TENDERS for the EXTENSION of PLANT at their Whiston Street Generating Station.

The requirements include—

Two 1,500 kw. Steam Turbo-Generators.
Condensers, Pumps, Piping, etc.

Specification, drawings, and general conditions may be obtained on and after Tuesday, June 27th, at the offices of the Borough Electrical Engineer, Coronet Street, N., on payment, by cheque, of £5, which will be refunded on the receipt of a *bonâ fide* Tender. The fee will not, however, be returned until the whole of the Tenders received have been finally considered.

Tenders, sealed and endorsed (on the left-hand corner of envelope) "Tenders for Turbo-Generators," should be addressed to the Town Clerk, Town Hall, Old Street, E.C., and must be delivered not later than noon of the 18th day of July.

The Council does not bind itself to accept the lowest or any Tender.

H. M. ROBINSON, LL.D.,
Town Hall, Shoreditch. Town Clerk.

CORPORATION OF LOUGHBOROUGH.

ELECTRICITY DEPARTMENT.

The GAS and ELECTRICITY COMMITTEE of the Loughborough Corporation invite TENDERS for the SUPPLY of the following MATERIALS and STORES for the year ending July 31st, 1906 :—

1. Oils.
2. Engine-room Stores.
3. Cables.
4. Cable Fittings and Accessories.
5. Meters.
6. D.P. Switches and Fuses.
7. 3-b.h.p. and upwards 440 Volt D.C. Motors and Starters.
8. ⅛-b.h.p. 3-b.h.p. 220-Volt D.C. Motors and Starters.
9. Ironmongery and Sundries.
10. House-Service Fuses.
11. Turbine Generator Brushes.

Schedules and Forms of Tender may be obtained on application to the undersigned.

Sealed Tenders, endorsed "Contract No. —," to be addressed to the Chairman of the Gas and Electricity Committee, Town Clerk's Office, Town Hall, Loughborough, and must be delivered not later than Tuesday, July 18th, 1905.

The Corporation reserve the right to accept the whole or part of a Tender, and do not bind themselves to accept the lowest or any Tender.

WALTER H. ALLEN,
Borough Electrical Engineer.
Electricity Works, Bridge Street, Loughborough,
June 27th, 1905.

COUNTY OF LONDON.—TO CONTRACTORS AND OTHERS.

The London County Council invites TENDERS for WORKS to be executed in connection with the Partial Reconstruction of Four Bridges carrying the Albert Embankment Road over dock entrances in the Borough of Lambeth, and of Mill Pond Bridge in Nine Elms Lane in the Borough of Battersea.

Persons desiring to submit Tenders may obtain the drawings, specifications, bills of quantities, form of Tender, and other particulars upon application to the Chief Engineer, Mr. MAURICE FITZMAURICE, C.M.G., at the County Hall, Spring Gardens, S.W., upon payment to the Cashier of the Council of the sum of £3.

This amount will, after the Council or its Committee shall have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender and not have withdrawn the same.

Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with.

The contractors will be bound by the contract to pay to all workmen (except a reasonable number of legally bound apprentices) employed by them wages at rates not less, and to observe hours of labour not greater, than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule.

Each Tender is to be delivered at the County Hall, in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Reconstruction of Four Bridges in Lambeth and Battersea."

No Tender will be received after 10 o'clock a.m. on Tuesday, July 18th, 1905.

Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk to the London County Council.
County Hall, Spring Gardens, S.W.

CAERPHILLY URBAN DISTRICT COUNCIL.

TENDERS are invited for the Supply, Delivery, Laying, and Erection of HIGH and LOW-PRESSURE UNDERGROUND CABLES, KIOSKS, TRANSFORMERS, SWITCH GEAR, LAMP PILLARS, &c.

Copies of the Specification, with General Conditions and Form of Tender, can be obtained from Messrs. PREECE AND CARDEW, 8, Queen Anne's Gate, Westminster, S.W., on payment of a deposit of One Guinea, which will be returned on receipt of a *bona fide* tender. Duplicate copies of the Specification can be obtained on payment of 5s. (non-returnable).

Sealed Tenders, endorsed "Tender for Electric Lighting," must be delivered to the Chairman of the Caerphilly Urban District Council, Council Offices, Caerphilly, on or before 12 o'clock noon on Monday, July 24th, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
Council Offices, Caerphilly. W. SPICKETT, Clerk.

APPOINTMENTS OPEN.

MINISTRY OF PUBLIC INSTRUCTION, EGYPT.

SCHOOL OF AGRICULTURE.

An INSTRUCTOR in LAND SURVEYING and FARM ENGINEERING is REQUIRED to begin work on September 30th in the School of Agriculture, Ghizeh (near Cairo).

Preference will be given to candidates having experience of practice and teaching. They should be from 23 to 33 years of age, unmarried, and have a robust constitution.

A University Degree or College Diploma is an essential qualification.

Salary about £295 per annum (£Eg. 24 per mensem), rising to about £393 per annum (£Eg. 32 per mensem). Allowance for passage out to Egypt. Bachelor quarters are provided.

Applications, with full statement of qualifications, and accompanied by copies only of testimonials, must be sent in before July 22nd, 1905, addressed to W. C. MACKENZIE, Esq., D.Sc., 5, The Crescent, Cromer, to whom candidates may apply for further information.

MINISTRY OF PUBLIC INSTRUCTION, EGYPT.

POLYTECHNIC SCHOOL OF ENGINEERING.

An INSTRUCTOR in ENGINEERING is REQUIRED, to begin work on September 30th, in the Polytechnic School of Engineering, Ghizeh (near Cairo).

The Instructor appointed will be engaged in teaching Descriptive Engineering and Hydraulics.

Candidates must have had practical experience as engineers, and have been engaged on work of a class intimately related to the subjects to be taught. They should be from 25 to 35 years of age unmarried, and have a robust constitution.

A University Degree or Diploma in Engineering is an essential qualification.

Salary about £430 per annum (£Eg. 35 per mensem), rising to about £553 per annum (£Eg. 45 per mensem). Allowance for passage out to Egypt. Bachelor quarters are provided.

Applications, with full statement of qualifications, and accompanied by copies only of testimonials, must be sent in before July 22nd, 1905, addressed to W. C. MACKENZIE, Esq., D.Sc., 5, The Crescent, Cromer, to whom candidates may apply for further information.

THE GOVERNORS OF THE WOOLWICH

POLYTECHNIC invite APPLICATIONS for the following APPOINTMENTS, which will date from next September :—

1. One Teacher for ENGINEERING Subjects at a commencing salary of £150 per annum.
2. One Teacher (Evening Classes only) for BUILDING CONSTRUCTION, BUILDERS' QUANTITIES, &c.

Further particulars of the above appointments may be obtained by sending to the Principal a stamped addressed foolscap envelope.

The last day for receiving applications is Friday, July 14th.

A. J. NAYLOR,
Clerk to the Governors.

HULL MUNICIPAL TECHNICAL SCHOOL.

LECTURER ON ELECTRICAL ENGINEERING.

A LECTURER on Electrical Engineering is required at the above School. Salary £200 per annum.

Further information and Forms of Application may be obtained from the undersigned, to whom applications should be sent not later than Saturday, the 15th of July.

J. T. RILEY, D.Sc.,
Director of Studies.
Education Offices, Albion Street, Hull,
June 26th, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages* 23 *and* 25.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. *for each additional section.*

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers, Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N.. 125, Strand, W.C.
World's Work and Play.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Case-Hardening Compounds.
Hy. Miller & Co.. Millgarth Works, Leeds.

Castings
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

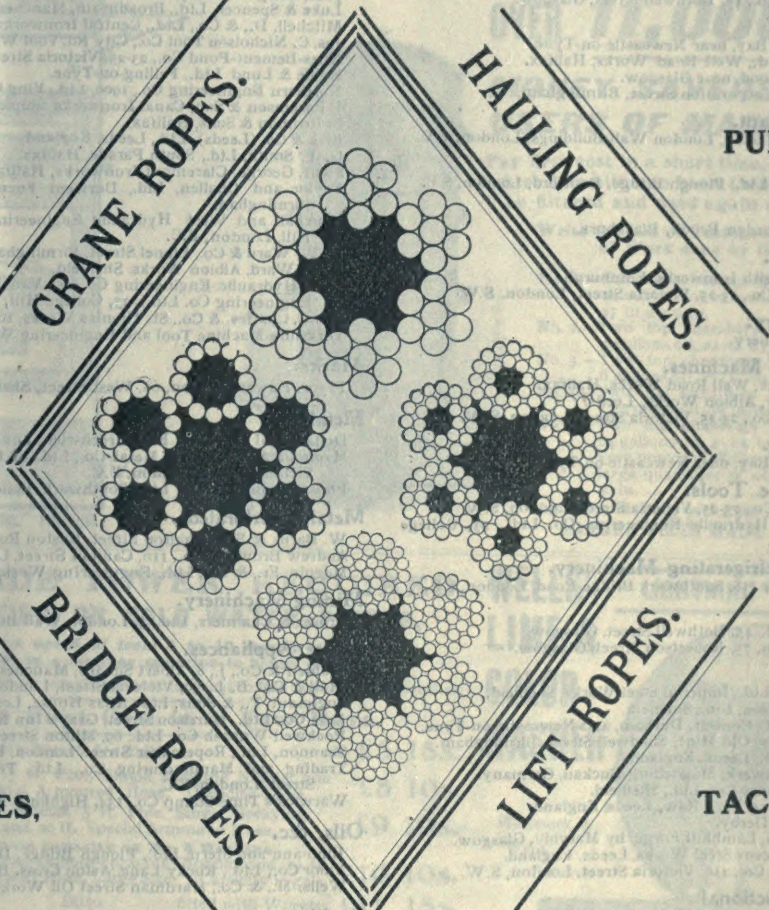
PAGE'S WEEKLY Mining Ropes, &c.

BULLIVANTS'

Steel Wire Mining Ropes.

Wire Ropes for Hauling and Winding Gear, and all operations connected with Mining.

BLOCKS, **PULLEYS,**



CRAB-WINCHES, **TACKLE,**

Stronger, Lighter, and Cheaper than Hemp Rope or Chain,
ABSOLUTELY RELIABLE.

A Piece of every Mining Rope tested to Destruction, and a Test Certificate Su

Registered Offi

BULLIVANT & CO., Ltd., 72, Mark Lane,

Telephone No.: 2110 AVENUE. **WRITE FOR PAMPHLET M.H.** **Works: MILLW**

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
Masons Gas Power Co., Ltd., Alma Works, Levenshulme, Manchester.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles. & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.
Andrew Brown & Co., 110, Cannon Street, London, E.C.
Méguin. Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.
Warwick's Time Stamp Co., 134, Highbury Hill, London, N.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

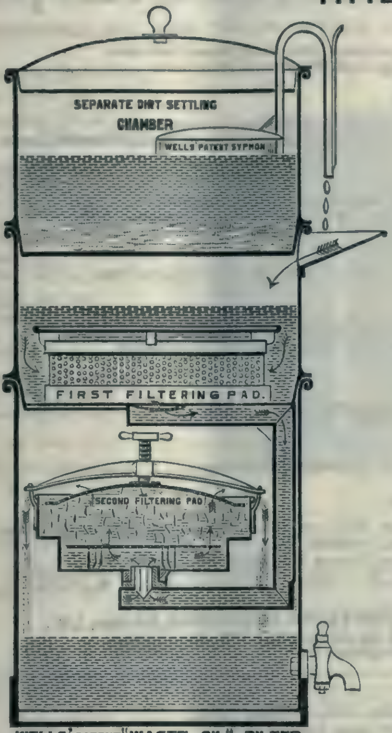
Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

PAGE'S WEEKLY Wells' Specialities

WELLS' PATENT "Waste Oil" FILTERS

FITTED WITH SIGHT-FEED SYPHON.



WELLS' PATENT "WASTE OIL" FILTER.

SUPPLIED TO THE PRINCIPAL GOVERNMENTS FOR THE NAVY, DOCKYARDS, &c., AND TO THE LEADING ELECTRIC LIGHT INSTALLATIONS, ENGINEERING WORKS, GAS ENGINE MAKERS, PRINTERS, &c., &c.

OVER *11,000* SOLD.

MONEY SAVERS to any USERS OF MACHINERY.

Pay first cost in a short time, as Dirtied Oil, which has hitherto been thrown away, can be filtered and used again and again.

Write for List of Testimonials and Samples of Work done by the Filter.

No. 1.	For users having only a small quantity of oil to treat (no syphon) 17 in. by 9 in.	35/-
No. 2.	Two top chambers hold about 3 gallons oil, 22 in. by 10 in. ..	50/-
No. 3.	Two top chambers hold about 6 gallons oil, 27 in. by 12 in. ...	70/-
No. 4.	Two top chambers hold about 12 gallons oil, 36 in. by 16 in. ...	110/-
No. 5.	Two top chambers hold about 24 gallons oil, 43 in. by 23 in. ...	189/-
No. 6.	Very powerful Filter for treating large quantities of oil, 54 in. by 30 in.	336/-

Capable of dealing with 250 Galls. Oil per week
LARGER SIZES MADE TO ORDER.

NO OUTSIDE POWER REQUIRED.

LIME, WHITING, OR COLD WATER PAINTS,

Applied at a speed of from 8 to 10 square yards per minute, in a manner superior to brush work.

One coat with the Machine on rough surfaces is equal to two applied with brushes.

Will save First Cost in a Few Days.

No. 6A.	Small Size with Detachable Rail	£5 15s.
No. 4.	Price, with 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose. Capacity 6 gals.	£8 10s.
No. 4A.	Price, with Wheels, 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose, **Same capacity as No. 4 Machine.**	£9 10s.
No. 5.	With 5-ft. Pole, Double Spraying Nozzle, and 20 ft. Special Armoured Hose, Large Size. Capacity 10 gals.	£10 10s.
No. 5A.	Ditto Ditto fitted with Wheels.	£11 15s.

WELLS' "LIGHTNING" LIME & COLOR WASHER

Wallwork & Wells' Patents.

No. 4a, with Wheels.

WELLS' IMPROVED LIMEWASH.

MUCH SUPERIOR TO ORDINARY LIMEWASH. SLAKED WITH WATER. QUICKLY MIXED. WILL NOT RUB OFF. LEAVES A GOOD SURFACE.

Price 13/8 per cwt.,
Carriage Paid in England and Wales, (If in lots of 3 cwt. at a time, 12/8 per cwt.)

A. C. WELLS & Co.,
100a, Midland Road, St. Pancras,
Works: Cheetham, Manchester. LONDON, N.W.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.

Wm. Firth, Ltd. Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent

Riveted Work.

P. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roller Bearings.

Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Stamps (Time).

Warwick's Time Stamp Co., 134, Highbury Hill, London, N.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 40, Paradise Street, Liverpool, and 100c, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 75, Cannon Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Hunt & Mitton, Crown Brass Works, Oozells Street North, Birmingham.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Weighing Apparatus.

W. & T. Avery, Ltd., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., 100A, Midland Road, St. Pancras, London, N.W.

Wind and Water Supply Machinery.

Eric S. A. Smith, Bridlington.

Wire Working Machinery.

Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."

"Woodite" Company, Mitcham, Surrey.

PAGE'S WEEKLY Miscellaneous

Boltons' Downtake Superheater WITH DOUBLE CIRCULATION.

IMPROVED BOX AND "FIELD" TUBES. (PATENTED.)

Simple and Reliable. Readily Applied. Inexpensive.

Saves 10 to 15 %

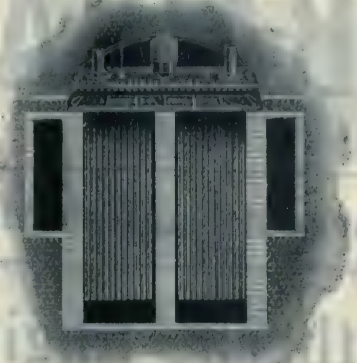
Is made of Steel throughout.

A large number working in—
Textile Mills,
Paper Works,
Collieries,
Electricity Stations,
Flour Mills, etc.

Suitable for any Working Pressure up to 200 lbs. per square inch.

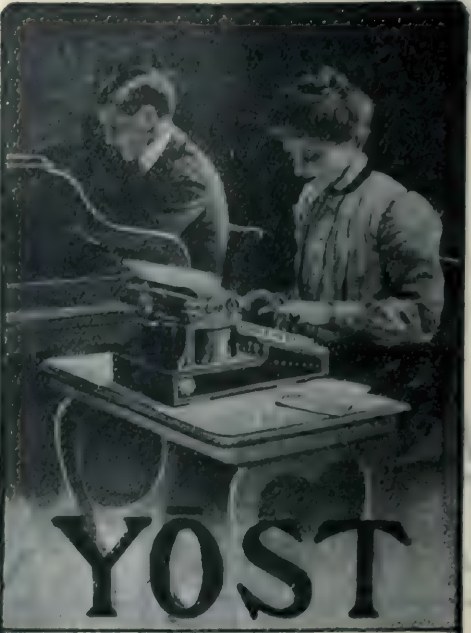
Approved of by Leading Engineers and Insurance Co.'s.

REPEAT ORDERS BEING GIVEN.



PATENTEES AND SOLE MAKERS:—

A. BOLTON & CO.,
Engineers and Superheating Specialists,
49, Deansgate, MANCHESTER.



YŌST

THE TYPEWRITER FOR BEAUTIFUL WORK.

Catalogue on Application.

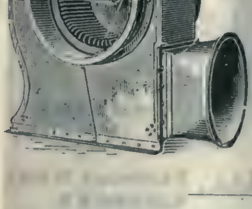
THE YŌST TYPEWRITER CO., Ltd.,
50, Holborn Viaduct, London.

FOR THE BEST BOOKS BEARING ON THE INDUSTRIES DEALT WITH IN "PAGE'S WEEKLY," viz., ENGINEERING, ELECTRICAL, IRON AND STEEL, MINING AND SHIPBUILDING, ASK FOR CATALOGUE, CHARLES GRIFFIN & CO., LTD., 12, EXETER STREET, STRAND, LONDON, AND SEE SPECIAL ADVERTISEMENT ALTERNATE WEEKS.

CYCLONE FANS FOR VENTILATION.

MATTHEWS & YATES, Ltd.
Swinton, Manchester.

Highest Award, Grand Prize, St. Louis Exhibition, 1904.



"SIROCCO" FANS,

For Induced Draught on Boilers, Heating, Cooling, Ventilating, etc.

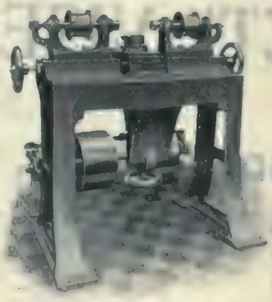
DAVIDSON & CO., LTD.,
"Sirocco" Engineering Works, Belfast

13, Victoria St., Westminster, LONDON, S.W.
37, Corporation St., MANCHESTER.
115, Hope St., GLASGOW.

Sole Continental Representatives: Messrs. WHITE, CHILD, & BENEY, Ltd., 62/63, Queen St., Cheapside, LONDON, E.C.

Cunliffe & Croom, Ltd.,

BROUGHTON LANE,
Manchester.



Double Brass Finishers' Milling Machine.

Write for New List of Tools for

Brass Finishers.

PAGE'S WEEKLY Machine Tools

3 Styles of Drive | *Belting* / *Belting and Gearing* / *Gearing*

3′6″ to 6′0″ RADIALS

HIGHEST RATE OF FEEDS . .

Largest English Makers.

Northern Engineering
(1900) Co., Ltd.,
HALIFAX.

"ABOUT VISES."

A BOOKLET (FOR THE ASKING)

By the Makers of the

"PERFECT" VISE.

J. PARKINSON & SON,
SHIPLEY, ENGLAND.

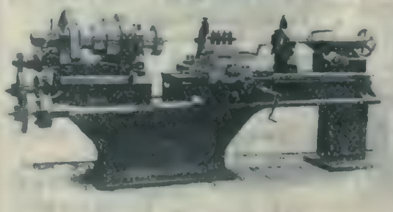
Cables:—"TEMPLES, SHIPLEY."
Code: A B C 5th Edition.

Electric Hauling **GEARS**

Main and Tail Main Rope, Endless Rope and Portable, Hoisting, and Hauling Gears.

M. B. WILD & CO., 35 and 36, Clarence Chambers, Corporation Street,
BIRMINGHAM.

HIGH-CLASS LATHES & RADIAL DRILLS.



Write for our Lists.

Telegrams: "Tools, Keighley."

D. MITCHELL & CO., Ltd., Parsonage Works, KEIGHLEY.

On War Office and India Office Lists.

JONES & LAMSON

MACHINE CO.,
97, Queen Victoria Street,
LONDON.

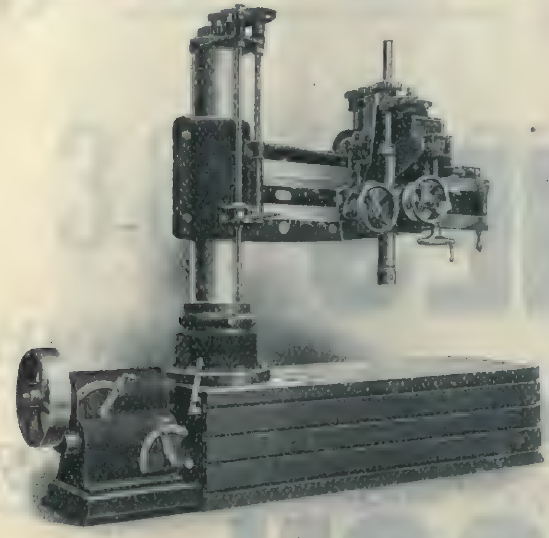
Hartness Flat Turret Lathe,
with Cross-Sliding Head.

(The only Turret Lathe of the kind on the market.)

PAGE'S WEEKLY Machine Tools

GEORGE SWIFT,

290, Claremont Road, HALIFAX.

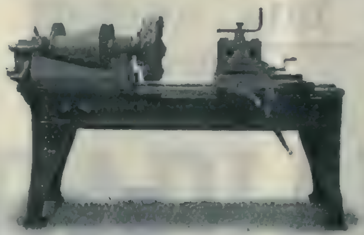


Above is Illustration of my **6′ 0″ Radial**, with sixteen Speeds and nine Feeds, all obtained instantly by levers.

There are several special features in this and other tools made by me, and shall be glad to send full particulars on request.

HIGH-SPEED LATHES

OUR SPECIALITY



HIGH-GRADE MACHINES

only, in stock for Immediate Delivery.

(Established 1871.)

C. REDMAN & SONS, Parkinson Lane, HALIFAX.

ALL OUR LATHES

ARE FITTED WITH

Patent Bed, Patent Loose Head,
Patent Screw-Cutting and Feed Motions.

INVESTIGATE THESE POINTS BEFORE BUYING.

JOHN LANG & SONS,
Johnstone, near GLASGOW.

GREENWOOD & BATLEY, Ld.

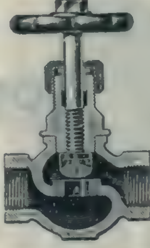
LEEDS.

Machine Tools.

Dynamos & Motors.

De Laval's Patent Steam Turbines.

The "SHAW" Patent Steam Valves . .



With Renewable Seats, Interchangeable Concentric Valve, Compound Packing to Spindle, Special Metal, and High-Class Workmanship.

The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

Try Them ! Sent on Approval.

☞ *Write for particulars of these and other Specialities for High Pressure Steam.*

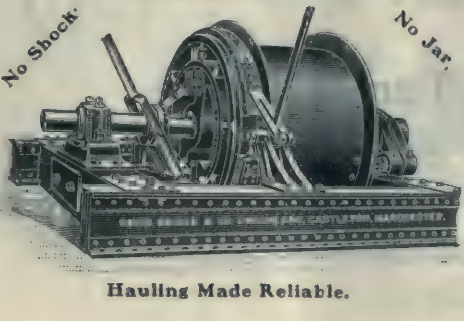
JOSEPH SHAW, B Dept., Albert Works, HUDDERSFIELD.

HEYWOOD & BRIDGE'S PATENT FRICTION CLUTCH and SHAFT COUPLING.

Prevents Accidents.

WE MAKE CLUTCHES, SHAFTING, GEARING and HAULING INSTALLATIONS A SPECIALTY.

Sixty Page Work—Free.
DON'T MISS THIS.


No Shock.
No Jar.

Hauling Made Reliable.

Patentees and Sole Makers:

DAVID BRIDGE & CO.
Castleton Iron Works,
ROCHDALE, LANCS.

London Office:
35, Queen Victoria Street,
E.C.

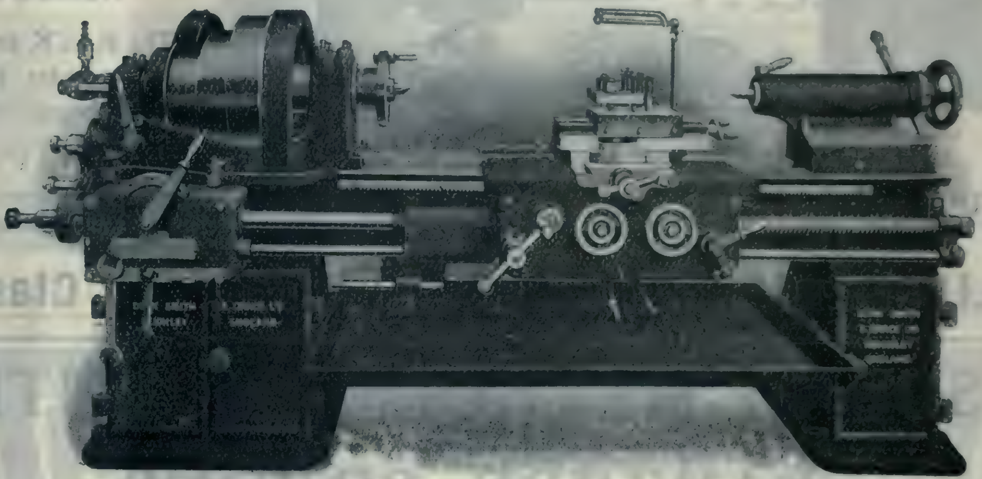
PAGE'S WEEKLY Machine Tools

WE MAKE

High-speed Lathes

From 6½ in. to 20 in. Centres. ONLY.

SPECIAL DESIGNS! UNIQUE FEATURES!



The illustration shows a 8½ in. centre Lathe, specially designed for **Heavy Work at High Speeds,** suitable to its capacity. It has **Large Range of Speeds,** suitable for all classes of work.

POSITIVE FEEDS, SAFETY INTERLOCKING MOTIONS TO SADDLE, AND AUTO STOP. TROUGH PUMP, &c., &c.

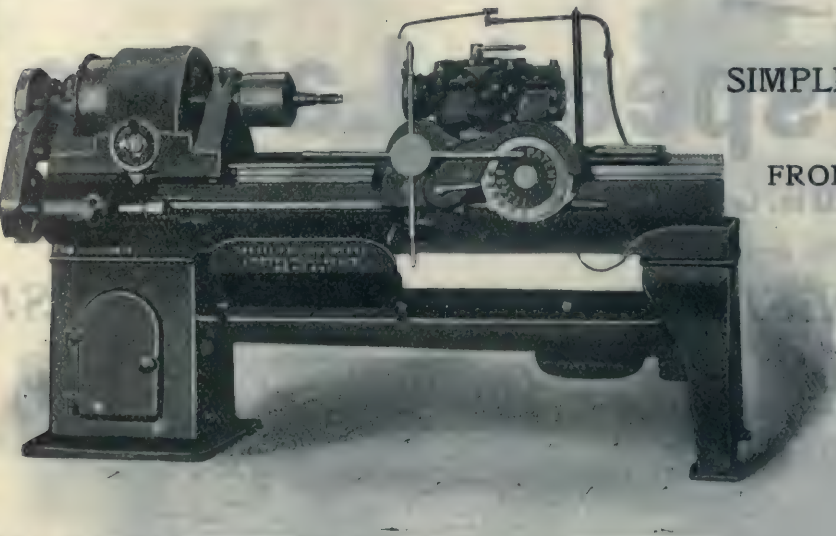
WRITE FOR 1904 CATALOGUE.

A perfect combination of Speed, Power, and Rigidity, with Ease of Manipulation.

DEAN, SMITH & GRACE, Ltd.,
KEIGHLEY. Established 1865.
London Agents: **BUCK & HICKMAN, Ltd., Whitechapel Road.**

PAGE'S WEEKLY Machine Tools, &c.

TURRET LATHE SPECIALISTS.



Note the
SIMPLICITY of this LATHE.
DIRECT DRIVEN
FROM THE MAIN SHAFT.

VARIABLE SPEED
HEADSTOCK.

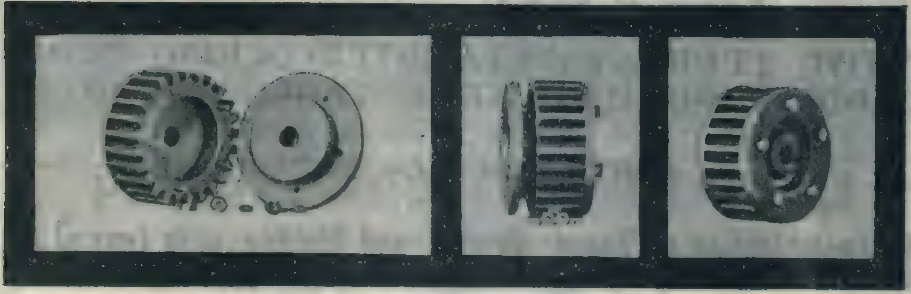
The RACK and GUIDE direct under the cutting tool being completely covered.

ALL HANDLES and STOPS within reach of the Operator.
THE ONLY CORRECT GRIP CLUTCH.

Telegrams: "CRITERION, LINWOOD."
Telephone: 4Y JOHNSTONE.

ECLIPSE TOOL MFG. CO., Linwood, nr. Glasgow.

A SOUND METHOD of MOUNTING
RAWHIDE PINIONS.

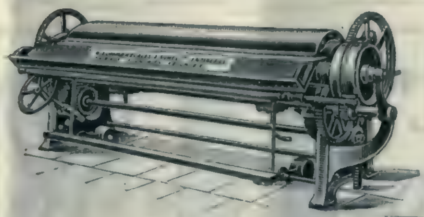


For further particulars and for Prices of all kinds of Gearing, write to—

AD. AHLERS, Whitley Bay,
near NEWCASTLE-ON-TYNE,
ENGLAND.

Telegrams:
"Ahlers, Whitley Bay."

PAGE'S WEEKLY Machine Tools, &c.



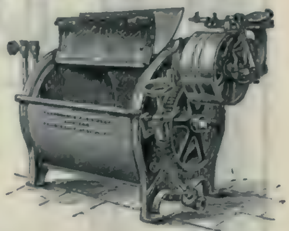
LAUNDRY MACHINERY

. . AND . .

Cooking Apparatus.

CATALOGUE ON APPLICATION.

EXPERT ADVICE GIVEN.



W. Summerscales & Sons, Ltd.,

Phœnix Foundry, KEIGHLEY, ENGLAND.

PLEASE MARK INQUIRIES P.W.

Telegrams: "MILLING, SHEFFIELD."
National Telephone No.: 985.

For the Latest and most Up-to-Date

HEAVY = =
MACHINE
TOOLS = =

PLATE BENDING MACHINE.

Also Special Lifting Jack for Electric Tramcars.

WRITE . .

GEORGE ADDY & Co.,

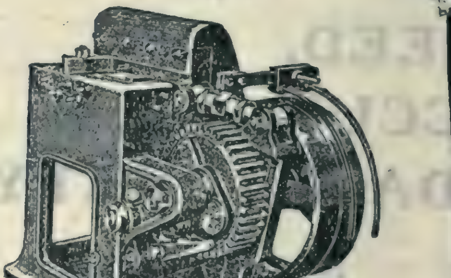
WAVERLEY WORKS, SHEFFIELD

C. W. Hasenclever Söhne DÜSSELDORF.

Special Machinery

FOR MAKING

Bolts, Nuts, Rivets,
Insulator Brackets,
Horse-Shoes,
Horse-Shoe Nails,
Calkins, and
Similar Forgings.



ROLLING MACHINE FOR IRON SCREW THREAD.

PAGE'S WEEKLY Miscellaneous

HERBERT W PERIAM L^TD.
FLOODGATE S^T WORKS
BIRMINGHAM.
TELEGRAPHIC ADDRESS
"FLOODGATE" BIRMINGHAM.
TELEPHONE Nº 373.
STOCK 250,000. GROSS

BRADBURY'S

Newly Designed

Standard Milling Machine

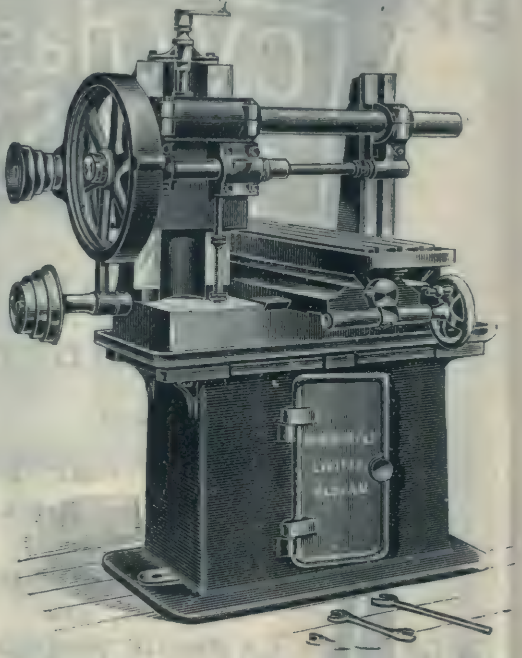
For

SPEED,
ACCURACY,
ADAPTABILITY,

IS **A 1.**

Prices and Particulars from - -

BRADBURY & Co., Ltd., *Wellington Works,* **OLDHAM.**



PAGE'S WEEKLY Systems for Engineers

Save Half Your Time !

Do you realise that old-fashioned business methods are time consuming ?

Do you appreciate the fact that labour is the most expensive item you have to consider in your executive departments ?

Do you know that many of our clients voluntarily state that we have saved them 50 per cent. in executive expense by the use of **ROCKWELL-WABASH BUSINESS SYSTEMS ?**

The moral is obvious, you owe it to yourself to see what we can do for you, and if you will kindly fill out the coupon below indicating the subjects that particularly interest you, we will send our Information Forms relating to them, and upon receipt of the information asked for, will arrange a system exactly suited to your requirements, or, if agreeable and convenient to you, we will have one of our representatives call, and he will be able to give you any information you require, and without expense to you, tell you **HOW TO SAVE HALF YOUR TIME.**

Messrs. ROCKWELL-WABASH CO., LTD.,

69, Milton Street, London, E.C.; 164, Buchanan Street, Glasgow; 50, Deansgate Arcade, Manchester.

Please send us your Information Forms relative to subjects below numbered......................................., which are to be sent without expense or other obligations upon us.

Name ______________________________

Address ______________________________

Business ______________________________

P-7 ______________________________

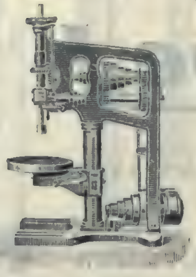
1. FACTORY COSTS
2. STORES LEDGERS
3. PERPETUAL CARD LEDGERS
4. QUOTATIONS—GIVEN
5. QUOTATIONS—RECEIVED
6. ADVERTISING RECORDS FOR ADVERTISERS
7. ADVERTISING RECORDS FOR AGENTS
8. ADVERTISING RECORDS FOR PUBLISHERS
9. STAFF REGISTER
10. CUSTOMER'S LISTS
11. ADDRESSING LISTS
12. FOLLOW-UP-SYSTEMS—SALES
13. FOLLOW-UP-SYSTEMS—OVERDUE ACCOUNTS
14. CREDIT RATINGS
15. SHAREHOLDERS' REGISTER
16. FILING CATALOGUES
17. FILING CORRESPONDENCE
18. FILING INVOICES
19. PATTERN RECORDS
20. DRAWING RECORDS
21. ORDER SYSTEMS
22. DOCTORS, DENTISTS, AND OCULISTS
23. MEMBERSHIP RECORDS
24. INSURANCE RECORDS FOR COMPANIES
25. INSURANCE RECORDS FOR BROKERS
26. INSURANCE RECORDS FOR AGENTS

PAGE'S WEEKLY Miscellaneous

THE

Jos. C. Nicholson Tool Co.

Machine Tool Makers, NEWCASTLE-ON-TYNE.



Horizontal, Vertical Pillar, Radial, and Wall Radial

DRILLING MACHINE

Sole Makers of the "STANDARD" Hand Power WELDING and FORGING MACHINE.

Write for "Green" Catalogue.

BATEMAN HIGH-SPEED PLANERS

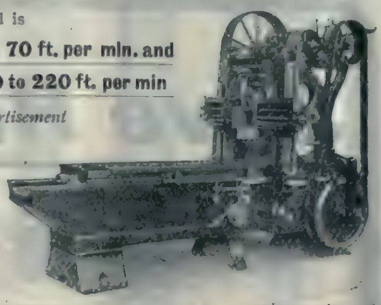
The Machine illustrated is

Cutting at 60 to 70 ft. per min. and

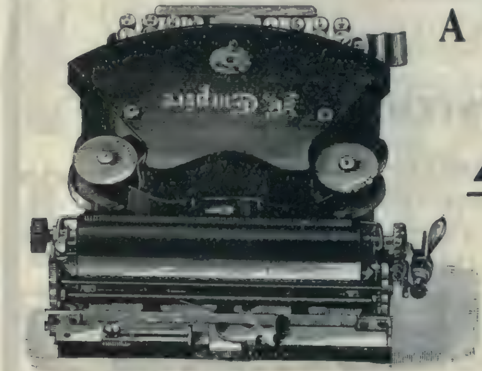
Returning at 200 to 220 ft. per min

See our half-page Advertisement alternate weeks.

BATEMAN'S
MACHINE
TOOL
CO., Ltd.,
Hunslet,
LEEDS.



24 in. x 24 in. 6 ft.



A NEW PRINCIPLE IN TYPEWRITERS.

Type bars do not swing but are supported to point of contact with platen, thus securing

ACCURATE ALIGNMENT.

Price £13 2s. 6d.

Contractors to His Majesty's Government.

THE EMPIRE TYPEWRITER CO., LTD.,
77, Queen Victoria Street, E.C.

CATALOGUE COVER.

Those who issue CATALOGUES ought to see this.

COVER WITH SECTIONAL CATALOGUE INSERTED.

New Editions as issued can be inserted, old Editions withdrawn.

CHEAP AND EFFECTIVE.

Sample Cover on application:—

THE TRADING & MANUFACTURING CO., Limited,
27, Fleet Street, LONDON, E.C.

Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

PAGE
Addy, George, & Co. ... 19
Ahlers, Ad. ... 18
Allen, Edgar, & Co., Ltd ... 5
Allgemeine Elektricitäts-Gesellschaft —
Allis-Chalmers Co. ... —
Anderson & Son, Ltd., D. ... 28
Ashmore, Benson, Pease & Co. ... —
Askham Bros. & Wilson, Ltd. ... 5
Asquith, William, Ltd. ... —
Atlantic Press ... 41
Avery, Ltd., W. & T. ... —

Babcock and Wilcox, Ltd. ... 3
Baldwin Locomotive Works ... 28
Barns & Son, W. ... —
Bateman's Machine Tool Co. ... 22
Baynes, Charles ... —
Beldam Packing and Rubber Co. ... 26
Benn, Sykes ... 24
Bennis & Co., Ltd., Ed. ... 31
Bertrams, Ltd. ... 5
Binney & Son ... 26
Bleichert & Co., A. ... —
Blumann & Stern, Ltd. ... 24
Bolton & Co., A. ... 13
Booker & Sullivan ... 3
Booth & Bros., Ltd., Joseph Inside Back Cover
Bradbury & Co., Ltd. ... 20
Brand, Ed. ... —
Brett's Patent Lifter Co., Ltd. ... 4
Breuer, Schumacher & Co. ... —
Bridge & Co., David ... 16
British Advertiser Service Bureau ... 39
British Steam Specialities, Ltd. ... —
Broadbent & Sons, Ltd., Thos. ... —
Broadbent, T. W. ... —
Brown, Andrew, & Co. Inside Front Cover
Buckley, Samuel ... —
Bullivant & Co., Ltd. ... 9

PAGE
Cambridge Scientific Instrument Co., Ltd. ... 39
Campbell Gas Engine Co. ... 5
Capell Fan Co. ... —
Clarke's Crank & Forge Co., Ltd. ... —
Clayton, Son, & Co., Ltd. ... —
Concentric Condensers, Ltd. ... 34
Consett Iron Co., Ltd. ... —
Cort, Arthur, & Co. ... —
Crosby Lockwood & Son ... —
Crypto Electrical Co. ... 3
Cunliffe & Croom, Ltd. ... 13

Davidson & Co., Ltd. ... 13
Davis & Primrose ... 3
Dean, Smith & Grace, Ltd. ... 17
Deighton's Patent Flue & Tube Co., Ltd. —
Delange & Cie, Mc. ... —
Delta Metal Co., Ltd. ... —
Denison, S., & Son ... —
Dobbie-McInnes, Ltd. ... 3
Drum Engineering Co. ... —

Eclipse Tool Manufacturing Co. ... 18
Elliott & Fry ... 38
Elliott-Fisher Co. ... —
Empire Typewriter Co. ... 22
Enke, Carl ... —

Fairbanks Co. ... —
Fairley & Sons, James ... Outside Back Cover
Farnley Iron Co., Ltd. ... —
Firth, Ltd., William ... —
Fleming, Birkby & Goodall, Ltd. ... —
Fowler, John, & Co. (Leeds), Ltd. ... 28
Fraser & Chalmers, Ltd. ... —
Frictionless Engine Packing Co., Ltd. —

Garrett & Sons, Ltd., R. Inside Back Cover
Gent & Co., Ltd. ... 37

PAGE
Gibbs, J., & Son ... 36
Gilmour, W. & O. ... —
Glover & Co., M. ... 4
Graham, Morton & Co., Ltd. ... 3
Grantham Crank & Iron Co., Ltd. Inside Front Cover
Green & Son, Ltd., E. ... —
Greenwood & Batley, Ltd. ... 16
Griffin & Co., Ltd., Charles ... 13

Hadfield's Steel Foundry Co., Ltd. ... —
Hagan's Locomotive Works ... —
Halden & Co., J. ... —
Hall & Co., B. J. ... 38
Hall & Sons, Ltd., J. P. ... —
Hamilton & Co., J. B. ... —
Hannan & Buchanan ... 3
Hardy Patent Pick Co ... —
Hartley & Sugden, Ltd. ... 4
Hasenclever Söhne, C. W. ... 19
Hathorn, Davey & Co., Ltd. ... —
Head, Wrightson & Co., Ltd. ... 4
Heenan & Froude ... 5
Holmes & Co., W. C. ... 42
Horsfall Destructor Co. ... 5
Howard Bros. ... 40
Howes Co., S. ... —
Hudswell, Clarke & Co., Ltd. ... —
Hughes & Lancaster ... 4
Hughes, G. H. ... 3
Hunslet Engine Co. ... —
Hunt and Mitton ... 32
Hyatt Roller Bearing Co. ... —

India Rubber, Gutta Percha, and Telegraph Works Co., Ltd. ... —
Inglesant, T., & Sons, Ltd. ... —

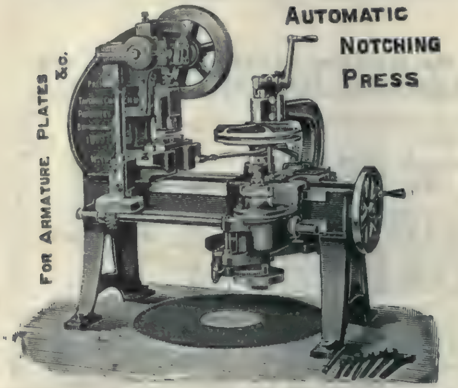
Jones and Lamson Machine Co. ... 15

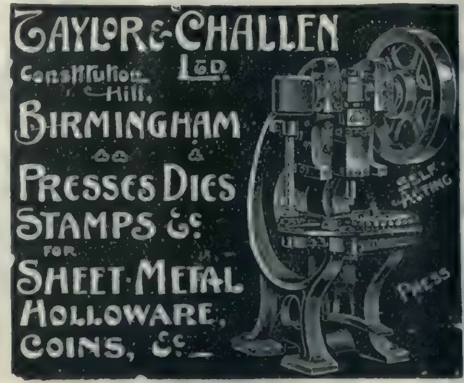
John I. THORNYCROFT & CO., LTD.,
Makers of . . . All Types of Steam and Petrol Vehicles.
WORKS: CHISWICK, SOUTHAMPTON, BASINGSTOKE. MOTOR VEHICLE DEPT: HOGARTH LANE, CHISWICK, W.

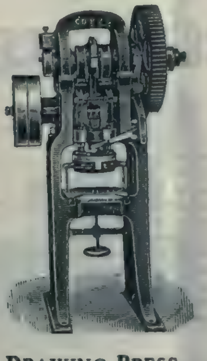
SÜDDEUTSCHE KABELWERKE A.-G., Mannheim, GERMANY.
(SYSTEM BERTHOUD BOREL.)
Contractors to the Imperial German Postal Authorities.

Silk-Covered Copper Wires.
TELEPHONE CABLES.
With Paper and Air Insulation.
LEAD-COVERED CABLES
For all Tensions up to 40,000 volts.

PAGE'S WEEKLY Miscellaneous




TAYLOR & CHALLEN LTD.
Constitution Hill,
BIRMINGHAM
PRESSES DIES STAMPS &c. FOR SHEET-METAL HOLLOWARE, COINS, &c.


DRAWING PRESS.

Benn's Patent Combined Air-Pump, Condenser, and Delivery Box.

SYKES BENN,
Engineer,
HASLINGDEN, LANCS.

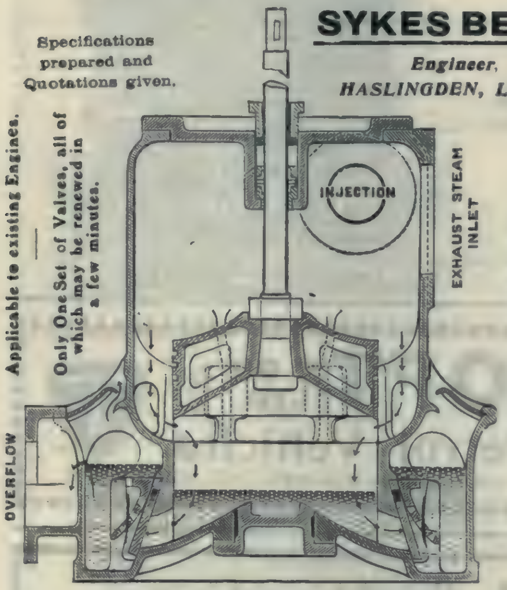
Specifications prepared and Quotations given.

Applicable to existing Engines.

Only One Set of Valves, all of which may be renewed in a few minutes.

For Jet, Surface, or Evaporative Plants.

Steam, Electric, Rope, or Belt-Driven.



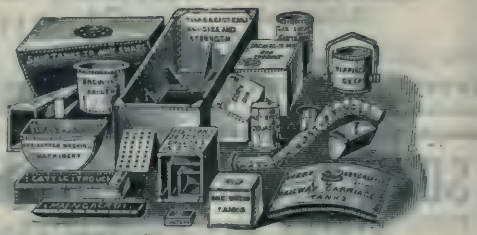
INDEPENDENT
CONDENSING PLANTS

OIL SEED AND CAKE MILLS.
GRAB DREDGERS.
OIL REFINERIES.

Rose, Downs & Thompson, LTD.,
Old Foundry, HULL,
and
12, Mark Lane, LONDON, E.C.

WATER SOFTENING PLANT.

F. A. KEEP, JUXON, & CO.,
Manufacturers of
TANKS, CISTERNS
and CONSTRUCTIONAL IRONWORK.



Forward Works, Barn Street, **BIRMINGHAM.**

HIGH-CLASS LUBRICANTS FOR MACHINERY OF EVERY DESCRIPTION.

LAND and MARINE ENGINE and CYLINDER OILS.
DYNAMO and GAS ENGINE OILS.
CRANK CHAMBER and STEAM TURBINE OILS.
MOTOR and CYCLE OILS.
SOLIDIFIED OILS and GREASES for all PURPOSES

BLUMANN & STERN, LTD. Plough Bridge, Deptford, LONDON, S.E.
Contractors to H.M. Government, Home, and Foreign Railways, &c.

Index to Advertisers—(Contd.)

PAGE
Keep, F. A., Juxon & Co. ... 24
Keith, J., & Blackman Co., Ltd. ... —
Krupp, Fried. ... —

Lancaster & Tonge, Ltd. ... —
Lang & Sons, John ... 16
Leckenby, Benton & Co. ... —
Leeds Forge Co., Ltd. ... —
Lepard & Smiths, Ltd. ... —
Luke & Spencer, Ltd. ... —
Lyle Co., Ltd. ... 37

Mabie, Todd & Bard ... —
McLaren, J. & H. ... 28
Magnesia Coverings, Ltd. ... 42
Magnolia Anti-Friction Metal Co., Ltd. —
Masons Gas Power Co., Ltd. ... —
Mather & Platt, Ltd. ... —
Matthews & Yates, Ltd. ... 13
Meldrum Bros., Ltd. ... 30
Melling, J. F. ... —
Melville and Macalpine ... —
Metallic Paint Co., Ltd. ... —
Miller & Co., Hy. ... —
Mirrlees-Watson Co., Ltd. ... 29
Mitchell, D., & Co., Ltd. ... 14
Mix & Genest ... —

Nalder Bros. & Thompson ... —
New Gutta Percha Co., Ltd. ... —
New Zealand Mines Record ... —
Newton Bros. ... —
Nicholson Tool Co., Jos. C. ... 22
Niles-Bement-Pond Co. ... —
Noble & Lund, Ltd. ... —
Northern Engineering Co. (1900), Ltd. —
Northern Railway of France... 35
Nye, Arthur W. ... 26

Page & Rowlingson ... 3
Parker Foundry Co. ... 5
Parkinson & Son, J. ... 14
Pegg & Sons, S. ... 4
Periam, Ltd., H. W. ... 20
Phœnix Dynamo Mfg. Co., Ltd. ... 36
Phosphor Bronze Co., Ltd. ... —

PAGE
Piggott & Co., Ltd., Thos. ... 4
Positive Rotary Pumps, Ltd. ... 34
Pratt & Whitney Co. ... —
Premier Boiler Tubes, Ltd. ... 27
Pryor & Son, Edward ... —
Purden & Sons, John ... Outside Back Cover

Quaker City Rubber Co. ... —

Recorders, Ltd. ... 4
Redfern & Co., S. ... 25
Redman & Sons, C. ... 10
Reid Gear Co. ... —
Reliance Lubricating Oil Co. ... 5
Rice & Co. (Leeds), Ltd. ... —
Richardsons, Westgarth & Co., Ltd. 33
Richter, Gustav ... —
Riter Conley Manufacturing Co. ... —
Robinson & Co., Ltd., T. D. ... 3
Rockwell-Wabash Co., Ltd. ... 21
Roller, A. ... —
Rose, Downs & Thompson, Ltd. ... 24
Rossendale Belting Co., Ltd. ... —
Rubber Stamp Co., The ... —

St. Helen's Cable Go., Ltd. ... —
Samson & Co. ... 35
Sankey & Son, J. H. ... —
Schieren & Co., Chas. A. ... —
Schnicke, H. F. ... 38
Scotch and Irish Oxygen Co., Ltd. ... 5
Scott, Walter, Ltd. ... 4
Shannon, Ltd. ... —
Shaw, Joseph ... 16
Smith, Eric, S. A. ... 3
Smith, Ltd., G. F. ... —
Smith & Sons, of Saltley, Ltd., Thomas —
Soest & Co., Ltd., L. ... —
South-Eastern & Chatham Railway... —
Southwood, Smith & Co. ... —
Spon, E. & F. N. ... —
Spottiswoode & Co., Ltd. ... —
Stafford, Arthur, & Co. ... 38
Stamm, W. ... —
Stirling Boiler Co., Ltd. Outside Back Cover
Sturtevant Engineering Co., Ltd. ... 27
Süddeutsche Kabelwerke, A.-G. ... 23
Summerscales & Sons, Ltd., W. ... 19

PAGE
Swain & Son, Ltd., John ... 36
Swift, George ... 16

Tangyes, Ltd. ... —
Taylor & Challen, Ltd. ... 24
Temperley Transporter Co. ... 4
Thom, John Z. ... —
Thompson & Co., Gilbert ... —
Thornycroft & Co., Ltd., John I. ... 23
Tomey, J., & Sons ... 4
Trading and Manufacturing Co., Ltd. 22
Treasure & Co., J. B. ... 25
Tubes, Ltd. ... —
Turner, Atherton & Co. ... —

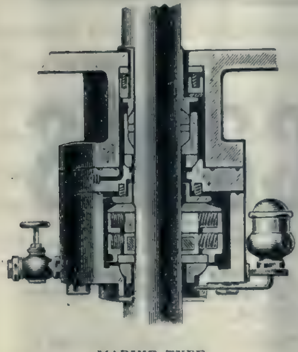
United States Metallic Packing Co., Ltd. 25

Valor Co., Ltd. ... —
Vauxhall and West Hydraulic Engineering Co., Ltd. ... —
Von der Heyde, J. Bennett ... 25

Ward & Co., H. W. ... —
Ward, T. W. ... 4
Warwick's Time Stamp Co. ... 39
Waygood & Co., Ltd. ... 3
Weaver & Co., B. ... 36
Weise & Monski... —
Wells & Co., A. C. ... 11
Wells & Co., M. ... 42
West & Co., Ltd., H. J. ... —
West Hydraulic Engineering Co. ... —
West Pascagoula Creosoting Works —
Wild, M. B., & Co. ... 14
Williams & Co., J. H. ... Inside Front Cover
Winn & Co., Charles ... 4
"Woodite" Co. ... —
"World's Work and Play" ... —
Wrigley & Co., Ltd., E. G. ... —

Yorkshire Patent Steam Wagon Co. —
Yorkshire Machine Tool and Engineering Works ... —
Yost Typewriter Co., Ltd. ... 13

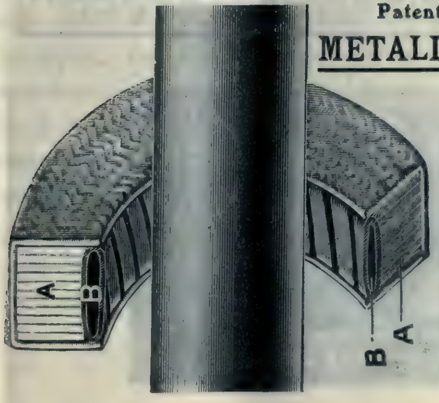
Zeitz & Co. ... 5



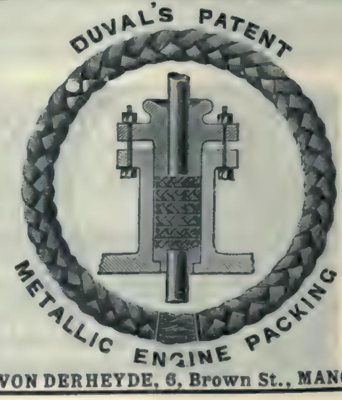
MARINE TYPE.

THE
PACKING
OF
PACKINGS
Used by . .
British, United States, Dutch, Spanish, Japanese, etc., Navies.
UNITED STATES METALLIC PACKING CO., LTD.,
BRADFORD.

J. B. TREASURE & Co.
Excelsior Fire-Polished
GAUGE GLASSES,
LUBRICATORS,
INDIA-RUBBER WASHERS,
&c., &c.
Vauxhall Road, Liverpool.



Patent Flexible
METALLIC FACED
PACKING
For all Pressures.
S. REDFERN,
Swan Lane,
New Brown St.,
MANCHESTER.



A PURE METALLIC PACKING.
Lasts for many years, and keeps the Rods in perfect condition.
DUVAL'S PATENT METALLIC ENGINE PACKING
Used same way as ordinary soft.
For all classes of Engines and Superheated Steam.
J. BENNETT VON DERHEYDE, 6, Brown St., MANCHESTER.

PAGE'S WEEKLY Miscellaneous

Telephone No.: 8216 BANK. Telegrams: "NYRKE, LONDON.

ARTHUR W. NYE,

110, Cannon Street, LONDON, E.C.

Locomotives.
Railway Carriages.
Railway Wagons.
Wheels & Axles.
Wagon Ironwork
Axle Boxes.
Buffers and Draw-Gear.
Steel Castings.
Electric Transporters.
Electric Cranes.

Bridges and Dock Gates.
Structural Work.
Steel Rails.
Steel Sleepers.
Steel Sections.
Switches and Crossings.
Rail Spikes and Screws.
Fish-Bolts.
Tirefonds and other Accessories.

RAILROAD EQUIPMENT. PUBLIC WORKS. CONTRACTORS' PLANT.

BINNEY'S

"Asblubric" Lubricants

REGISTERED TRADE MARK.

you require REALLY FIRST-CLASS LUBRICANTS, or if you have any trouble with what you may be using, write to BINNEY & SON, stating for what purpose required, and they will be glad to forward samples for trial and full particulars of their "ASBLUBRIC" LUBRICANTS, which do not fail to give satisfaction.

Also at
BIRMINGHAM, LEEDS,
GLASGOW, and COVENTRY.

BINNEY & SON,
CATHERINE STREET, CITY ROAD, **LONDON.**
(L Dept.)

THE BELDAM PACKING AND RUBBER Co
93 & 94 GRACECHURCH St LONDON. E.C.
TELEGRAPHIC ADDRESS "CORRUGATED. LONDON"
CONTRACTORS TO THE ADMIRALTY & FOREIGN GOVERNMENTS, ALSO TO THE LEADING STEAMSHIP & OTHER COMPANIES.
THE R.M.S. CEDRIC (THE LARGEST STEAMER AFLOAT) IS FITTED WITH BELDAMS SPRING NECK BUSHES & TUBULAR PACKING &
WEAVERS & MANUFACTURERS OF EVERY DESCRIPTION OF ASBESTOS & RUBBER GOODS

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VII. LONDON, FRIDAY, JULY 14, 1905. No. 44.

The Offices of "Page's Weekly," Wednesday Evening.

THE appalling disaster to the French submarine *Farfadet*, following so closely upon the heels of the A8 tragedy, appears to have been due to an accident unconnected in any way with faulty construction. This view, at any rate, is given by M. Thomson, the French Minister of Marine, as the result of his inquiries, and as the Minister went down in a sister boat, the *Korrigan*, while attempts were being made to raise the sunken submarine, it must be admitted that he has the courage of his convictions. The frequency of submarine disasters and the pathetic fate of the crew of the *Farfadet* would seem to indicate that if submarine practice is to develop it will have to be coincident with a marked development in the efficiency of salvage apparatus.

The melancholy event naturally cast a shadow over the festivities at Brest where, as those who value the *entente cordiale* are not likely to forget, the ships of the French Northern squadron and those of the Atlantic fleet are lying side by side in the greatest of French military ports. The hospitalities which have been so lavishly showered upon our officers and men will, no doubt, be very heartily reciprocated when the French fleet visits Portsmouth.

An interesting proposition is on the tapis for the amalgamation under one roof of the great British engineering societies. The project is not entirely new, but its revival at the present moment is due to the fact that the site of

M. THOMSON.
The new French Minister of Marine.

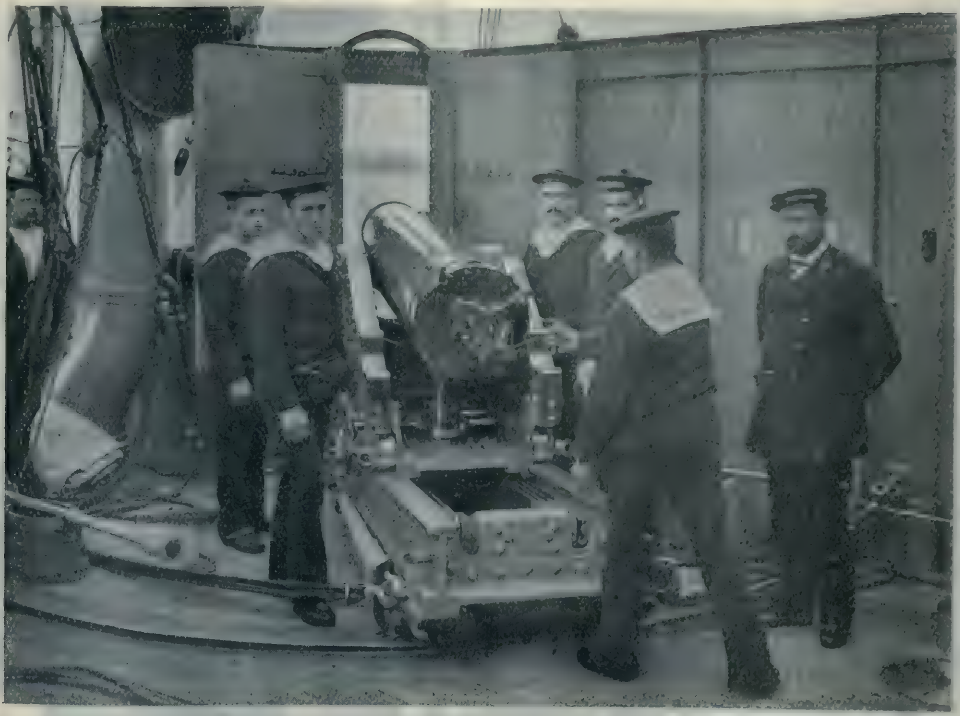
M. Thomson has been for a long period associated with naval matters, and is a born organiser. He was responsible for the reorganisation of the Conseil Supérieur, and has created a Comité Technique, which will replace the Conseil des Travaux and three other commissions.

the Institute of Civil Engineers—which is largely used by other institutions for meetings—will be required for extensions of Government buildings in the near future. Hence the opportuneness of the suggestion now made; it will no doubt receive the best consideration of the Councils of the institutions concerned.

Railwaymen will find a good deal that is instructive and suggestive in the return which has been presented to Parliament dealing with the derailments of engines of passenger trains inquired into by the inspecting officers of railways during the twenty years preceding December 31st, 1904. The report is divided into two sections, Tank Engines and Tender Engines, and it is to be noted that the number of cases dealt with in these sections is practically identical, being fifty-five in the first section and fifty-four in the second. With the fate of the Twentieth Century "Limited," with its nineteen fatalities fresh in mind and the sinister theories which have been formulated regarding it, one glances through this record of 109 cases with interest in order to discover how many were supposed to be due to malicious tampering with the permanent way. It was said that the derailment of an eight-wheeled tank engine on the London and South-Western Railway at Tavistock in March, 1898, was caused by the placing of an old fishplate on the outer rail, but the inspecting officer thought the probabilities were rather against this conclusion. He suggested that the derailment might be accounted for by the engine, which was of a description which was liable to oscillate violently when running down hill with loose couplings, as in this case, finding some unexpected weak spot in the permanent way and "spreading" or "bursting" the road. The report mentions another case in which a ten-wheeled tank engine left the metals on the Taff Vale Railway. Concerning this accident, which happened in April 10th, 1898, the conclusions of the inspecting officer were that the derailment appeared to have been caused by the engine running over a stone which seemed to have been deliberately placed on the outer rail of the curve by some malicious person.

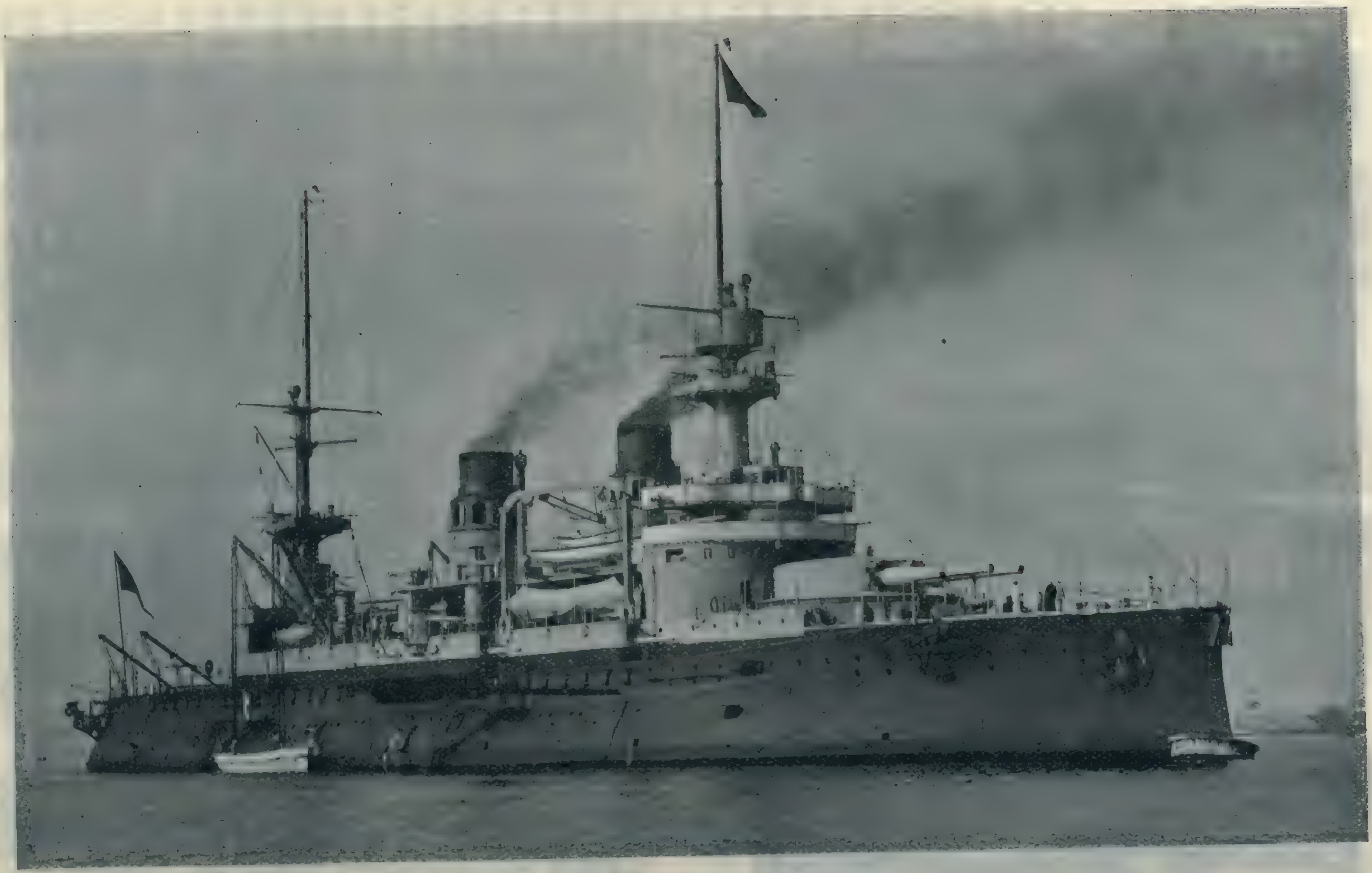
The report brings home to us the fact that in spite of the most strenuous precautions and carefully conceived systems, mistakes which seem almost unaccountable will at times be made by officials and platelayers. Here, for instance, is a case in which an engine was derailed through running over a measuring rod which had been left on the rails by permanent-way men engaged in the spot. This however, was in 1886, and the report shows that carelessness of this description is very exceptional. Several cases are to be noted in which points were not properly closed, and there are others tending to show signalmen, drivers, and booking porters very often literally carry the lives of the travelling public in their hands.

Defects, such as the fracture of an axle, the failure of a crank pin, the breaking of a tyre, the weight of engine badly distributed over the wheels, excessive oscillation, and even the dropping of a spring, have been responsible for their toll of accidents. In the report under consideration one cause of derailment recurs again and again; it is the negotiation of curves at too great a speed. This, in several cases being contributed to by an engine with a long rigid wheel base. Seeing that the condition of the permanent way itself has been responsible for not a few disasters, this report should have the effect of stimulating increasing watchfulness on the part of permanent-way inspectors. Worn rails, faulty sleepers, excess or want of super-elevation of the outer rail of curves and the undue expansion of rails caused by the heat of the sun are the causes of some of the accidents here described; others less preventable have resulted from snow blocking the points and from the slippings of banks.



FRENCH NAVAL GUN PRACTICE.

THE FRENCH BATTLESHIP "BRENNUS."—DISPLACEMENT, 10,983 TONS; SPEED, 18·2 KNOTS.



THE FRENCH BATTLESHIP "SAINT LOUIS."

Length over all, 385 ft. 6 in.; beam, 67 ft. 6 in.; maximum draught, 28 ft.; displacement, 11,260 tons. Engines, three sets of four-cylinder triple-expansion; twenty Belleville boilers with economisers. Heaviest gun, 12 in.; thickest armour, 15·7 in. I.H.P. 14,500. Speed, 18 knots.

THE FRENCH BATTLESHIP "JENA."

Length, 400 ft.; beam, 68 ft.; maximum draught, 27 ft. 6 in. Displacement, 12,052 tons. Engines, three sets four-cylinder triple-expansion; twenty Belleville boilers with economisers. Heaviest gun, 12 in. Thickest armour, 14 in. I.H.P., 1,506. Speed, 18 knots.

One of the best series of Cantor lectures delivered before the Society of Arts for some years was that of Mr. Dugald Clerk, who took for his subject a topic he has made his own, the internal combustion engine. The publication of the lectures in full is very welcome and they form a valuable contribution to the literature of certain problems in engineering which are daily assuming greater importance. In the first lecture, Mr. Clerk makes reference to some experiments he has recently made with a new type of apparatus to determine the temperature produced by gaseous explosion. These experiments clearly proved that such an explosion produces a maximum temperature of close upon 2,000 deg. C., and that this temperature arises with a pressure of slightly over 100 lb. to the square inch above atmosphere. So far most of the work which has been done on gaseous explosions has been made with coal gas and air mixtures, and little is even now known of the cooling curve of petrol, alcohol, and producer gas explosions except from the behaviour of such gaseous mixtures in the engines.

It is evident that much has yet to be done before all the actions going on in the cylinder of the internal combustion motor are fully understood, and if there is held clearly in our minds the efficiency possible with engines suffering no heat losses, subject to no complications as to chemical action or change of specific heat, it will be a key to open doors which are at present barred and indicate clearly the proper line of advance. Mr. Clerk himself points out the lines which investigation should pursue, and emphasises the importance of investigating the peculiarities of the numerous gaseous and vapour explosions now utilised in the internal combustion engine. He lays particular stress on the necessity for obtaining explosion and cooling curves from coal gas, petrol, alcohol, producer gas, and blast furnace explosions. In his second lecture, which will be published next week, Mr. Clerk discusses these matters in greater detail.

The Society of Chemical Industry, which is holding its annual session this week and next in England, is an institution with members all over the world. As Dr. William H. Nicholls, the President, stated in his presidential address on Monday last, with members residing in all parts of the globe, the society is British, though not insular. Broad in its conception and foundations, it welcomes men of science, theoretical or applied, of any country and any language. In the technical portions of his address, the President discussed the question of the management of a chemical industrial organisation, outlining a plan which he said had answered fairly well for the management of large and extended chemical industrial enterprises in the United States.

He specially emphasised the importance of the statistical department. After an organisation had been perfected and the machinery lubricated, he thought it would still be apt to run wild if some trustworthy method of control were not at hand. It was essential in a company operating a number of plants that those in control should know not only what each one of its manufactured products cost, but what entered into making up that cost. A statistical department had been able to advise the officers within a reasonable time after the end of each month not only of the cost of every product and step, but also of the profit and loss on each article, and the total profit and loss of the company. The results had been so exact that for several years the profits as determined by public accountants at the end of the year, had not varied 1 per cent. from those which had been worked up in this statistical department month by month. The importance of such information to those in control would be readily understood. For his own part he could not see how it would be possible intelligently to run a large enterprise involving a number of plants without some such arrangement.

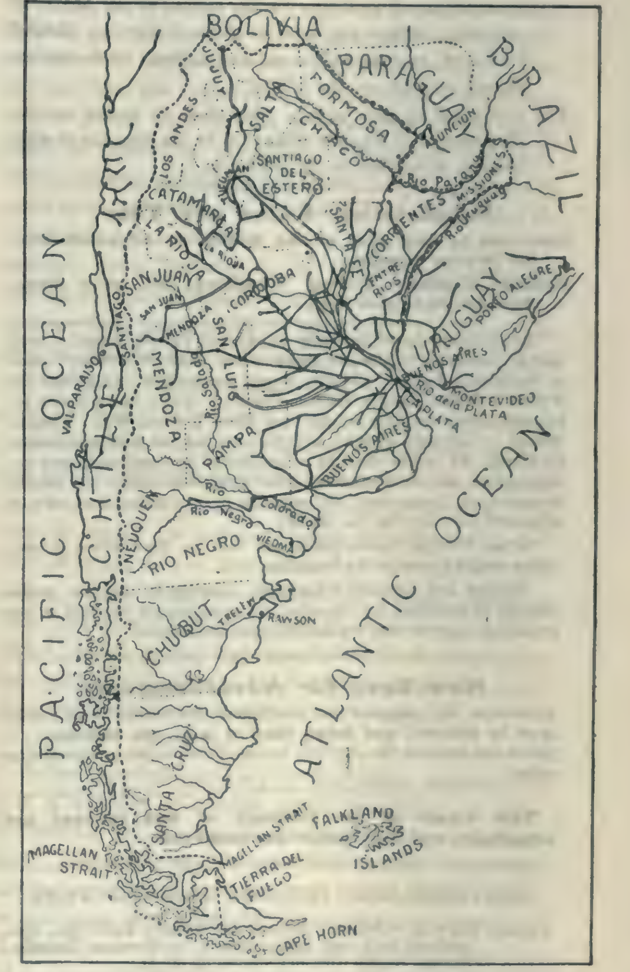
Wednesday will long be remembered in Sheffield as the inauguration day of its new University by King Edward VII. His Majesty, who was accompanied by the Queen, managed to crowd into the short space of three and a half hours a programme of a very exacting description, including a procession to the Town Hall, reception of numerous addresses, luncheon, the opening ceremony at the University, the King's presentation of colours to the second battalion King's Own Yorkshire Light Infantry, and a visit to the works of Messrs. Vickers, Son, and Maxim.

It is thirty years since the royal visitors were last in Sheffield, and both by decoration and acclamation every evidence was given of the desire on the part of the citizens to welcome their Majesties to the utmost.

At the River Don Works, as elsewhere, the decorations were of a most elaborate character. From the large four-span arch at the entrance to the works, through the yard and the different shops, special "pathways" were laid down for their Majesties to pass over, and in the centre bay of the south gun shop, a large number of completed weapons awaited their inspection, including an enormous 12-in. gun; two 10-in. naval guns; two 9·5 guns ready for the Canadian Government; four 6-in naval guns for Chile; a 13-pounder field gun for the Spanish Government, a pom-pom, a 3-pounder gun, and two Maxim guns. The operations in the rolling shed were witnessed from a special platform with glass windows. Another important inauguration—that of the new electro-technical laboratories of the Liverpool University—is dealt with at page 70. On Thursday His Majesty opened the new dock at Manchester.

If further proof were required that railway progress and the commercial prosperity of a country are generally concomitant, the case of Argentina might be quoted, and by way of clinching the argument one could scarcely do better than turn to the informative article on the Republic which Mr. John Barrett contributes to the current issue of the American Review of Reviews. The Argentine Republic has nearly 20,000 miles of trunk lines. Numerous new roads, branch routes, and feeders are being constructed or planned. It is possible to reach almost every portion of its wide area within forty-eight hours of the capital, the great city of Buenos Ayres. The transcontinental trains that convey travellers across the broad pampas and climb the Andes to connect with the road on the Chilean side are solid and vestibuled, with up-to-date dining cars. The tourist or business man can now go from Buenos Ayres, on the Atlantic, to Santiago in Chile and Valparaiso, on the Pacific, in seventy-two hours. There is a break in surmounting the summit at 15,000 ft. elevation between rail heads, but that is crossed in a few hours either in a coach or on horseback. In a few years a tunnel will be completed at the expense of the Chilian Government through the Cordilleras, and then the globe trotter can step into his palace car at Buenos Ayres and not leave it until he reaches Santiago. The building of this network of railways over Argentina has had two excellent effects—one to make successful revolutions almost impossible.

Now for the evidences of prosperity. Mr. Barrett sums up the salient features of the country as follows: Argentina is as large as half of the United States proper, and covers 1,200,000 square miles; it has a growing population of only 5,000,000, but an annual foreign trade of $450,000,000, or $90 per head; it is located in the south temperate zone, and is a "white man's country;" it is a great agricultural land, and its products are similar to those of the United States; it possesses extraordinary mining possibilities in the Andes; it has a seaboard, indented with many harbours on the Atlantic, of fifteen hundred miles, and is drained by the extensive navigable River Plate system; it is gridironed with up-to-date railroads; its government and constitution are similar to those of the United States. Buenos Ayres, the capital, has a population of one million, and is one of the most beautiful and prosperous cities in the world.



MAP OF ARGENTINA, SHOWING RAILWAY SYSTEMS RADIATING FROM BUENOS AYRES.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No: 3349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Editorial.—*All communications intended for publication should be written on one side of the paper only, and addressed to "The Editor."*

Any contributions offered, as likely to interest either home or foreign readers, dealing with the industries covered by the Weekly, should be accompanied by stamped and addressed envelope for the return of the MSS. if rejected. When payment is desired this fact should be stated, and the full name and address of the writer should appear on the MSS.

The copyright of any article appearing is vested in the proprietors of PAGE'S WEEKLY *in the absence of any written agreement to the contrary.*

Subscription Rates per Year.

Post free to any part of the world—In advance, 20s. for twelve months.

Sample Copies: United Kingdom, 6d., post free; Abroad, 8½d. post free.

Remittances should be made payable to PAGE'S WEEKLY and may be forwarded by Cheque, Money Order, Draft, Post Office Orders or Registered Letter. Cheques should be crossed "LONDON & COUNTY BANK, Covent Garden Branch." P.O.'s and P.O.O.'s to be made payable at East Strand Post Office, London, W.C. When a change of address is notified, both the new and old addresses should be given. All orders must be accompanied by remittance, and no subscription will be continued after expiration unless by special arrangement. Subscribers are requested to give information of any irregularity in receiving the Weekly.

When Foreign Subscriptions are sent by Post Office Orders, advice should be sent to the Publisher.

Foreign and Colonial Subscribers receiving incomplete copies through newsagents, are requested to communicate the fact to the Publisher, together with the agent's name and address.

New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

The whole of the contents of this journal are copyright, and full rights are reserved.

MEETINGS, ETC., FOR THE ENSUING WEEK.

FRIDAY, JULY 14.—Electric Tramway and Railway Exhibition, Agricultural Hall (last day).—Society of Chemical Industry: Annual Session (this and succeeding days).

WEDNESDAY, JULY 19.—Institution of Naval Architects: Summer Meeting at Society of Arts, (first day).—North of England Institution of Mining and Mechanical Engineers: Inspection of Barton and Forcett mountain limestone quarries.

NEWS ITEMS.

Mr. William Henry Cadman, B.Sc., third son of Mr. James Cope Cadman, acting President of the Institution of Mining Engineers, has just been appointed professor of science at the Government College, Alexandria, Egypt.

Messrs. Head, Wrightson and Co., Ltd., have purchased an extensive piece of ground for the extension of their Teesdale Iron Works at Thornaby-on-Tees.

Messrs. Crossley Brothers, Ltd., are erecting a 2,000 h.p gas producer for bituminous coal, with ammonia recovery, at their Openshaw works. This apparatus was made in the firm's new gas producer department.

The professors and heads of departments at the University of Oxford have drawn up a statement setting forth the details of a scheme for meeting all the present deficiencies in the organisation of the University. Among the alterations suggested is the provision of a Chair of Engineering at a capital cost of £30,000 and an annual expenditure of £3,000.

The gold output for the Transvaal for the month of May exceeds the previous record return—that for August, 1899—by £47,827. Nearly 7,000 stamps are at work—which is a record—and the Rand now produces 400,000 oz. per month, the gross value of the Transvaal output being £1,750,000 per month, or at the rate of £21,000,000 per annum. The tonnage crushed in May was approximately 1,000,000.

CONTENTS.

PAGE

Editorial Notes: The Festivities at Brest: French Submarine Disaster; M. Thomson: Derailments; Cantor Lectures; The Society of Chemical Industry; Sheffield's New University, etc. (*Illustrated*) 57
News Items (*Illustrated*) 64, 97
Engineering Tendencies in Germany 67
Materials used in Furnace Construction (*Illustrated*) 68
Opening of the New Electrotechnic Laboratory at Liverpool University..... 70
Shipbuilding Notes 73
The Three-phase 40,000-volt Power Transmission from Gromo to Nembro, Lombardia (*Illustrated*) 74
Openings for Trade Abroad... 77
Iron Ore Deposits Abroad. Possible Fields for Future Enterprise..... 78

PAGE

A Special Multiple Drilling Machine. By George Swift, Claremont Ironworks, Halifax (*Illustrated*) 80
Institution of Naval Architects 81
Improved Polishing Machine (*Illustrated*) 81
Our Weekly Biography—Sir E. Leader Williams, K.B. (*Portrait*) 82
The Future of Marine Gas Engines. By Peter Eyermann (*Illustrated*) 83
Obituary 89
A New Carbon Filament (*Illustrated*) 90
Trials of Gas Engines Worked from Suction Gas Producers 95
Motor Notes 96
American Notes 98
Contractors' News..... 99
Share List..... 101
Home Metal Market (*Chart*) 104
Prices Current..... 105
Selected Patents (*Illustrated*) 110
New Publications 112
Books Received 112
New Catalogues 112

The number of paying visitors at the Royal Agricultural Show was only 23,913 as compared with 52,930 last year, and was the lowest on record. It is said that the next show may be held at Manchester.

On Wednesday next an excursion meeting of the members of the North of England Institute of Mining and Mechanical Engineers will be held at Darlington for the purpose of inspecting the Barton and Forcett mountain limestone quarries.

A correspondent of the Birmingham Post writes that an important invention for the manufacture of steel has just been commercially effected by the manager of a South Wales steelworks. Under the new process it is estimated that the cost of producing steel of all grades of quality will be reduced fully 20 per cent.

No improvement is indicated in the condition of the Scotch shipbuilding trade, although the year's output now seems likely to exceed the average. The new work announced during June aggregates about 21,000 tons. The vessels launched during the month were twenty-nine in number, and represented 48,225 tons.

The Corporation of Western Egypt has appointed as its general manager in Egypt Mr. W. C. Beckett, M.Inst.C.E., who, in order to take up his new appointment, has resigned his position as chief engineer of the Bengal-Nagpur Railway, of which he also acted as agent and general manager during the two years Mr. T. R. Wynne, C.I.E., was in China.

The largest transaction in the whole history of the iron and steel trades of America has been announced during the week, involving the purchase of no less than 1,000,000 tons of billets by the Pittsburg Steel Company from the United States Steel Corporation. A contract has been entered into between the two companies by which the former agrees to purchase all the billets it may require for a term of years of the Steel Corporation, these to be delivered at the rate of between 16,000 and 17,000 tons per month, or 200,000 tons annually. It is understood that the deal has been consummated on a sliding-scale basis, the price to be fixed monthly, and based upon the average price of Bessemer pig, the cost of conversion, and the addition of a fair manufacturing profit. The steel will be largely supplied by the Clairton and Duquesne works of the Carnegie Steel Company and will include both Bessemer and open-hearth.

The death is announced of M. Edouard Simon, the eminent French engineer. The deceased was a prominent member of the Société d'Encouragement pour l'Industrie Nationale.

The Alexandra (Newport and South Wales) Docks and Railway Company, Newport, Mon., have instructed Messrs. Wm. Simons and Co., Ltd., Renfrew, to proceed with the construction of a powerful twin-screw bucket hopper dredger of 750 tons capacity, for the deepening of the above port. The dredger will be fitted with all the most modern improvements, and will be constructed under the direction of Mr. John Macaulay general manager of the company.

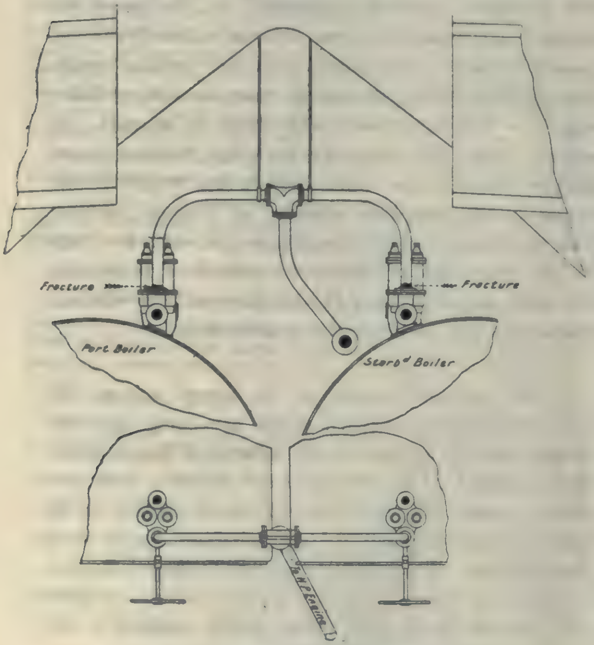
The Glasgow Herald states that with the new Channel steamer *Dieppe*, a new record has been established for the steam turbine. Much has been said —and perhaps not without some justification—against the system in respect of the manœuvring qualities, and the London, Brighton, and South Coast Company, in association with their Continental partners—the Western Railway of France—decided in this new steamer to exact exceptionally onerous conditions in starting and stopping tests. It was required in the contract that the vessel should stop within 100 metres or 109 yards, and because of this some of the firms asked to tender for the vessel refused, but the Fairfield Company agreed to the terms, and on the recent trials between Newhaven and Dieppe not only exceeded the speed by practically half a mile per hour, but between boats moored on the French coast exactly 100 metres apart brought the vessel to a state of rest in less than the stipulated distance. The speed of approach to the first boat as required by the contract was 12 knots. This was exceeded, yet the vessel was stopped and began reversing a few yards from the second moored vessel. This proves that the turbine system has greater stopping movement than one with ordinary engines. The time taken was about 40 seconds. As regards speed, the difficulty with the Newhaven and Dieppe boats is the limitations in the length of hull owing to the tortuous channel up Dieppe harbour. This precludes a greater length on the water-line than 280 ft., which makes high speed difficult of realisation, but with improvements in the harbour now contemplated this will be improved in later ships.

In the current number of the Syren appears the first of a series of articles which are being specially written for the journal by Sir Charles M'Laren, Bart., M.P., entitled "The Welsh Coal Fields." The first article covers the coal trade of Great Britain in its widest sense, with particular reference to the position of South Wales. Part 2 will deal with the special features of the South Wales coal fields, and the subsequent parts will be concerned with other details relating to the coaling operations of the district.

A Case of Excessive Vibration.

A report of preliminary inquiry into an explosion from the main steam pipes of the s.s. *Yarborough*, O.N., states that the pipes which failed are the branch pipes of the main range leading to the port and starboard boilers. They are about 7 ft. in length, and connect on to the boiler stop valve at one end, the other being connected to a Tee piece situated about 4 ft. above and midway between the two stop valves. Each pipe has a right angled bend with fairly large radius. The pipes are of solid drawn copper No. 5 S.W.G. in thickness and are 4½ in. internal diameter. The flanges are of brass and brazed on. A sketch of the main steam pipe arrangement is shown on the accompanying sketch. The two branch main steam pipes were fractured close to the flanges, owing to the straining produced by the structural movement of the machinery during heavy weather, the vessel being in ballast trim at the time. Through the promptitude of the chief engineer the steam was shut off the pipes as soon as the cracks were discovered, and temporary repairs were effected and the vessel steamed into Queenstown Harbour, where more permanent repairs were made. The vessel then proceeded on her voyage, which she completed without any further mishap.

It seems that on her return to the United Kingdom the engines were lifted from their seating to allow of repairs being done to the latter and from this it seems probable that the seating was originally somewhat weak, but the insufficient ballasting, having regard to the conditions of the weather, appears to have been the chief cause of the pipes cracking.



MAIN STEAM PIPING ARRANGEMENT.

The Zoelly Turbine.

A powerful syndicate has been formed in Germany, consisting of Krupp, of Essen, Marchinenfabrik, of Nürnberg, and Augsburg Norddeutsche Lloyd, Escher, Wyss and Co., and Siemens-Schuckert, for constructing the Zoelly turbine for marine and other purposes in Germany and elsewhere on the Continent. A similar combination has been made in France under the leadership of Messrs. Schneider, of Creuzot. In England a syndicate has been recently formed, consisting of Messrs. Escher, Wyss and Co., Messrs. A. G. Schiff and Co., and Messrs. Mather and Platt, Ltd., of Manchester, for the construction and sale of the Zoelly turbine in the United Kingdom and British Colonies, and for granting licenses under the Zoelly patents. Already Messrs. Escher, Wyss and Co. and their various licensees have over 30,000 h.p. of turbines at work or under construction.

We recently illustrated the Zoelly turbine in PAGE'S WEEKLY. It is a new form of "action" turbine, in which the motive power is obtained by the direct impact of steam jets moving at a high velocity against the vanes of the revolving wheels. Mr. Zoelly claims that the economy of his design is as great as in any other form of turbine, while he can attain this result with a much more substantial mechanical construction and a fewer number of parts.

W. and T. Avery, Ltd.

The report and statement of accounts issued by this company for the year ended March 31st last, reflect a strong financial position, and hold out decided hopes of a continuance of the ten per cent. dividend to be paid on the ordinary shares. The total available balance, after writing off £5,275 for depreciation, is £33,035, and after deducting interest on debentures, preference dividends, and interim dividends on the ordinary shares, there is a disposable surplus of £20,400. The balance dividend at the rate of 15 per cent. on the ordinary shares making ten per cent. for the year absorbs £7,996, which is little more than one-third of the sum available for dividend, so that it is clear that the company is being run on sound lines; and that profits are by no means being closely divided. By an addition of £5,000 out of the profits of the present year, the reserve fund is raised to £88,000, and as there is a sum of £74,216 standing to the credit of investments, it is evident that this is a real reserve fund, and not, as is too often the case, a fund merged in the general working capital of the business.

ENGINEERING TENDENCIES IN GERMANY.

RETURNS relating to the engineering trades show that business was not very prosperous in 1904, more especially as regards steam engines. We quote the following facts from a supplementary report by Mr. Consul-General Schwabach, dated June :—

Orders often had to be booked under cost price, and contracts for governments and municipalities were, owing to excessive competition, frequently only obtainable at unremunerative rates. The capacity of the works was still far ahead of the actual demand, and this disproportion was the more acutely felt as the growing use of large gas engines and steam turbines reduces the demand for steam engines. Pumping engines for water and sanitary plants, as well as boiler plants and central heating apparatus, were in good demand.

Gas Engines and Locomotives.

The building of gas engines of very large dimensions and capacity has made rapid strides and developed to a much greater extent than that of the small gas motor industry. Since 1903 there have been built by :—

	Number of Motors.	Total Horse-power.
Deutz	8	9,800
Körting	24	27,200
Nürnberg	22	33.000
Oechelhauser ..	10	9,800
Cockerill	22	29,700

Two motors, each of 3,200 h.p., were made for the Rhenish Steel Works at Meiderich and the Röchling Works at Völklingen.

Inland orders for locomotives, though plentiful, did not provide sufficient employment ; export orders were numerous, though not very profitable.

Transmission Machinery.

Transmission machinery was in good demand, as the revival of industrial life rendered new installations necessary. This branch is becoming more specialised, and modern plants are generally executed by special firms, as they alone are able to satisfy the increased technical requirements. Of the export markets Russia and Austria-Hungary were disappointing while orders from Italy and Switzerland, also France, were satisfactory, and the transatlantic trade, excepting that with the United States, was good.

Mechanical Tools.

A slight improvement took place in mechanical tools in 1904, and towards the end of the year there was a good demand for precision tool-making machinery as more and more works adopt the practice of manufacturing according to the various officially recognised interchangeable standards. Prices were still unsatisfactory through severe competition ; attempts to form price conventions were unsuccessful, the large number of different types manufactured and the great difference in quality rendering concerted action exceedingly difficult.

Electric Works.

The number of electric works in Germany on April 1st, 1904, providing power for lighting or industrial purposes, was 1,028, as compared with 868 in 1902.

The utilisation of electricity as motive power is increasing much more than for lighting purposes. At the Berlin Electric Works there were used (exclusive of power required for driving electric street cars) in 1897 for motive power 7,224 kilowatts, for lighting 14,601 kilowatts ; in 1904, for motive power 44,448 kilowatts, for lighting 36,195 kilowatts. Within the same period the number of motors supplied increased from 2,056 to 12,933.

According to a reliable estimate the number of hands employed in the German electric industry was 72,500 in 1904 (compared with only 26,300 in 1895 and 54,100 in 1898). The total capital invested in the electric industry is estimated at £30,000,000.

The New Tariff.

The German Government has now completed the revision of its new tariff, which will come into force on March 1st, 1906, remaining in effect until December 31st, 1917. This work, says the American Machinist, has evidently been done by experts in every branch. The section devoted to machinery has been quite recast, and it is difficult to compare the existing rates with those of the future. In some cases there are reductions, and in others increased duties are to be levied ; but what changes have been made are clearly due to a careful consideration of the position of certain German industries, and their special requirements in the shape of tools, raw materials or partly manufactured goods. The tariff on locomotives is to be raised from 8 to 11 marks per 100 kilos (220 lb.) ; steam engines, from 8 to 75 marks ; knitting machines, from 8 to 12 marks ; metal and woodworking machinery, from 3 to 8 and from 4 to 12 marks, etc.

MATERIALS USED IN FURNACE CONSTRUCTION.

By R. S. Hutton and J. R. Beard.

THE importance of a knowledge of the heat conductivity of the materials used for the bricks or linings of furnaces scarcely needs to be emphasised. There is no doubt that a careful study of this subject would enable a very large saving to be effected in the fuel or other heating costs in many experimental and industrial furnaces. The manufacturer and purchaser of refractory products both seem to ignore the necessity for accurately determining the quality of their material so far as its heat insulating power is concerned. Their specifications are confined to other properties, but it is doubtful if any of them are of greater economic importance than the heat conductivity.

So far as laboratory crucible and muffle furnaces are concerned H. H. Cunynghame has recently shown how greatly the efficiency can be improved by the adoption of better insulation.

Despite the lack of knowledge the measurement of thermal conductivities of such materials is by no means difficult to carry out, at any rate to within an accuracy of 2 or 3 per cent. C. H. Lees and J. D. Chorlton have specially designed a simple apparatus for measuring the thermal insulation of bad conductors. We are much indebted to Dr. Lees, who very kindly lent the apparatus and also gave much valuable advice in carrying out the experiments here described.

All the substances dealt with have been either in the state of well-defined granular powders, or in some few cases where bricks have been examined, these were previously broken up and finely powdered.

The authors have carried out a number of determinations, chiefly with granular materials, such as magnesia, carborundum, sand, and firebrick. By adopting an apparatus devised by C. H. Lees and J. D. Chorlton, they have been able to measure the conductivity of such powders at temperatures up to 100 deg. C. The chief results are summarised in the table on this page.

Substance *	Thickness in cm	Temperatures. Degrees centigrade.			Conductivity
		t_3	t_2	t_1	K
Sand. White Calais	0·360	98·4	81·0	18·2	·00060
Carborundum (fine)	0·363	98·7	78·8	18·3	·00050
" (coarse)	0·358	98·7	79·6	18·7	·00051
Quartz "Enamel"	0·362	99·3	75·4	21·7	·00036
" (fused)	0·362	98·9	74·9	17·4	·00039
Firebrick	0·363	98·7	60·2	20·3	·00028
Retort Graphite	0·363	100·0	70·0	19·6	·00040
Lime	0·363	98·1	70·1	20·8	·00029
Magnesia (fused)	0·356	98·7	78·6	20·0	·00047
" "Mabor" Brick	0·360	99·7	80·0	18·8	·00050
" Calcined Greek	0·365	99·3	78·3	20·4	·00045
" Calcined "Veitsch" ...	0·366	99·7	73·9	20·0	·00034
" Pattinson's Light Calcined	0·363	98·0	58·5	19·7	·00016
Kieselguhr (Infusorial Earth) ...	0·366	97·9	53·9	17·7	·00013

* Most of these granular powders just passed through a sieve with 600 meshes per sq. cm.

RELATIVE VALUE OF DIFFERENT HEAT INSULATING MACHINES.

It is not advisable to choose a material suitable for furnace uses from the tabular data alone.

Firstly, it is always necessary to know the general effect upon the substance under investigation of such temperatures as are likely to be experienced. Several even amongst those materials mentioned in the table are unsuitable for subjecting to high temperature on account of the physical changes, such as shrinkage, which they undergo. Chemical action, especially oxidation, also renders many insulators unsuitable for a large number of purposes. Secondly, having by such considerations excluded all unsuitable materials from the choice, it becomes necessary to compare the relative efficiency of those which remain under conditions more nearly approaching those experienced in practice.

The experiments were carried out with a view to testing in as simple a manner as possible the behaviour of various refractory materials at comparatively high temperatures. The method employed although it does not lend itself directly to the accurate measurement of the absolute conductivities at any rate offers a practical means of making comparative tests.

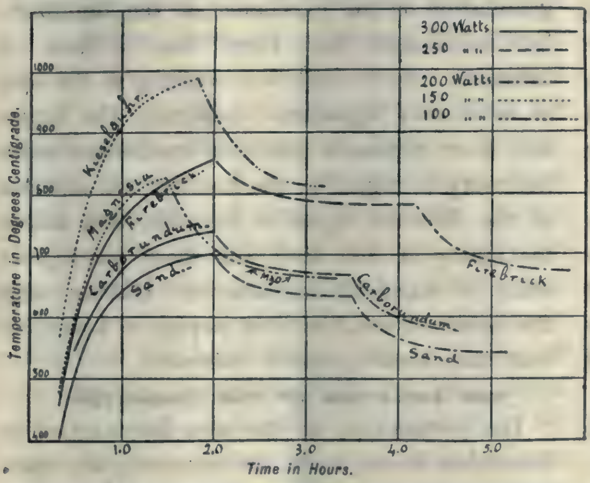
A modified form of electrically heated tube furnace was employed. An unglazed porcelain tube, with a heating coil of nickel wire, is supported at the centre of a cylindrical, water-cooled enclosure, the space between the heating coil and the inner wall of the enclosure being filled with the granular material under investigation. (See curve on next page.) The electric energy expended in the wire is kept constant over a considerable period by careful adjustment of an external resistance and constant observation of a precision wattmetre. The temperature at the centre of the porcelain tube is noted at regular intervals, and from the observations a curve is plotted to show the relation between the rise of temperature and the time during which the heating was in progress. In such an experiment it would require a long time for the temperature to attain a constant value. It is from a comparison of the heating curves with different materials, and the same expenditure of power, and particularly from the nearly horizontal portion of the curves with lower power expenditure, that valuable conclusions can be drawn.

In the case of firebrick, carborundum and sand, the preliminary heating was effected with 300 watts, and after the lapse of about two hours the power was reduced to 250 watts, being kept constant at this for a period of one and a half to two hours, by which time the temperature had become almost constant.

The curves for kieselguhr (infusorial earth) and light magnesia, clearly show the very much smaller conductivity of these materials.

With these two substances the preliminary heating was effected with an expenditure of only 150 watts, but despite this the rise in temperature is more rapid than with any of the other materials mentioned.

Unfortunately, neither light magnesia nor infusorial earth can withstand any high temperatures for long without losing their efficiency to a considerable extent. Both substances exhibit large shrinkage at high temperatures, and their chief uses are likely to be limited to external jacketing of furnaces lined with some more permanent but less good insulator.



CURVE SHOWING RELATIVE INSULATING POWER OF MATERIALS.

To more thoroughly test the above method of comparing the relative efficiency of different materials at high temperatures, it was thought advisable to see what influence the preliminary heating might have on the results.

Two similar experiments were therefore carried out with the various substances. In the first case the preliminary stage of the heating was effected with 300 watts, in the second with 250 watts. In both cases the power was subsequently reduced to 200 watts, and then to 150. The results showed that in all those cases in which no permanent alteration is brought about in the materials under test, the horizontal portions of the curve are practically identical, whatever the preliminary treatment had been.

In earlier experiments, in which no water cooling had been used to maintain constant the temperature of the outer jacket of the enclosure, some anomalous results were obtained.

GENERAL CONCLUSIONS.

The above results will, it is hoped, prove of value to those who have to deal with refractory materials. The subject seems to have been much neglected, considering that the thermal conductivity of such substances is the characteristic property which is really applied in their many uses.

Whilst bricks and jacketing materials generally for furnaces should be of low thermal conductivity, it is of no less importance to choose crucibles, retorts, and other containing vessels which are heated externally of as high conductivity as is feasible in conjunction with their other necessary qualities. Such methods as have been described are equally applicable to this latter case.

By a judicious use of the different materials and a stratified form of construction, it should be possible usefully to employ such excellent insulators as infusorial earth without risk of the damage which is inevitable if they be permanently subjected to too high a temperature.

The above experiments were carried out in the Physical Laboratories of the Manchester University.*

BALANCED ELECTRODES.

In a paper read before the last meeting of the Faraday Society, Professor W. W. Haldane Gee advocates the use of balanced electrodes. He points out that while this weight voltameter furnishes us with an extremely accurate method for the determination of current strength, its use requires care and time, and he claims that the use of suspended electrodes is worthy a place amongst laboratory, test-room, and workshop methods as a means of quickly arriving at a result that is sufficiently accurate for many purposes. It enables decisions between rival methods to be settled with comparative ease. Being an indicator of coulombs, it has the advantage over the use of an ammeter which must be periodically read in order that calculations relating to quantity can be effected. He has found an Oertling 16-in. beam balance very convenient for the purpose.

---

* From paper read before the Faraday Society.

THE OPENING OF THE NEW ELECTRO-TECHNIC LABORATORY AT LIVERPOOL UNIVERSITY.

SATURDAY last witnessed the opening by Sir Joseph Swan of the new electro-technic laboratory at Liverpool. In the course of an address on the advance of electrical science Sir Joseph remarked that electrical engineering was the most popular branch of a popular profession, and undoubtedly was a pursuit well worthy to be most assiduously cultivated. It must be so cultivated if we were to maintain our position in science and commerce. The electrical engineer had, in fact, become absolutely indispensable, and the army of young men composing the Institute of Electrical Engineers had to make productive an amount of capital which Mr. Garcke reckoned at nearly £250,000,000 sterling.

This large sum would undoubtedly have been still larger if the economic conditions prevailing in England had tended in a less degree to restrict expansion in this class of investment. For want of a little more enterprise, coupled with the knowledge and painstaking necessary to apply it judiciously, we had lost to our better technically trained rivals abroad some of the lead we originally possessed almost by birthright. It was a shock to patriotic sentiment to find how often the product of alien lands had installed itself in the very birthplace of the steam engine and the dynamo.

Electrical industries were, however, still in their infancy; the struggle was not ended; new electrical industries would arise, and those we already knew would grow to a size we little dreamt of now. There was, therefore, yet room for a shifting of positions to our advantage before the climax was reached. There were many signs of rapidly-increasing industrial change, with electricity as its cause. It was well that Liverpool was realising this, and preparing to participate in whatever advantages it might bring. During the period of evolution Liverpool had kept well in touch with electrical progress, and it might almost be said to have revelled in an electrical atmosphere. He was glad to see that in the college course and in the laboratory provision was made for the carrying on of research by students of approved ability and promise. Hence he was glad to be able to entertain the hope that the new laboratory might not only be productive of advantage to the students of the University, but to the University itself and to the world. A Davy or a Faraday was a rare product: but there was nothing at all unnatural in the idea or impossible in its realisation, that sooner or later names of equal eminence might be identified with the new laboratory.

In the course of a subsequent speech Sir Joseph Swan sounded a note of hearty congratulation on the excellence of the buildings, but mentioned that there was a lack of furniture. Very much was wanting in the way of laboratory apparatus, especially the larger and more expensive pieces of machinery quite necessary in regard to the construction and use of the different types of dynamo, and heavy machinery of that kind, and there was a great want of standard instruments. Having built the house, it went without saying in Liverpool that they would properly furnish it.

THE EVOLUTION OF THE LABORATORY.

The completion of the new laboratories in Brownlow Street marks the beginning of a fresh stage in the study of electro-technics at Liverpool. In 1900, a lectureship in electro-technics was established and made independent of the professor of physics; while three years later, in 1903, Mr. David Jardine expressed a wish that his gift of £10,000 to the fund then raised to forward the establishment and equipment of the new University of Liverpool, should be used to endow a chair of electro-technics. Effect was given to Mr. Jardine's desire; and Dr. E. W. Marchant, who then had served as lecturer for about two years, was appointed to the professorship.

At the same time it was recognised that the existing accommodation was wholly inadequate to meet the needs of the department, or to admit of expansion and growth. A site in Brownlow Street was obtained, and a sum of £12,000 was advanced from the University Fund to provide for the cost of a new building. The Lancashire County Council also contributed £1,000 to meet the most pressing needs of equipment.

THE LABORATORY DESCRIBED.

The buildings, now completed, form one block with the new laboratories of Natural History and the Botanical Laboratory, presented a few years ago to the University by Mr. W. P. Hartley. The site has distinct advantages. It is in close relation to the engineering department and to the chemical laboratories. It has a double access—from Brownlow Street in front, and from a passage-way behind. It also admits of extension, hereafter, whenever the growth of the department makes further expansion necessary. And by arrangement with the neighbouring department of Natural History, nearly the whole of the basement space under both buildings has been secured for electrotechnics, so providing a number of rooms on a foundation of solid rock. Class-rooms, lecture-rooms, and elementary laboratories are placed on the upper floor; and at the top of the building accommodation has been added for a small department of geology. No space has been wasted, and every room has been arranged to serve the purpose to which it is best adapted.

The general plan of the laboratories is very simple. All rooms required for experimenting with heavy machinery are placed at the back of the site. The basement in the frontage is set apart for electrical measurements of various kinds, and for purposes of research. The rooms for standards and for meter testing, where the highest degree of accuracy is required, are placed at the end of the building, remote from the dynamos and their vibration.

THE DYNAMO-ROOM.

The dynamo room is at the back of the building, with access from the passage. It averages 56 ft. long by 60 ft. wide, and is trapezoidal in shape. It is lined with glazed bricks, and has a glass roof over two-thirds of its area. The floor is of concrete. The machine beds have foundation rails set in them, and the rails are so placed that any machine can be speedily and firmly bolted down in any desired position. The room is divided into three bays; one is intended for testing direct-current machinery, and another for work with alternating currents, the third is at present occupied by a Westinghouse vertical two-cylinder gas engine, coupled to a dynamo, which can be used for lighting the whole block of the new buildings, and by a tramcar body with complete electrical equipment.

The lighting of the building is so arranged that the lamps can be connected either to the Corporation main or to the gas engine set. In this way all the lamps in the building are available for experimental purposes, and this part of the equipment serves as a small-scale generating station. Beside the switchboard used for lighting, an experimental board of special design is placed at one end of the laboratory, which is connected with all the machines in the laboratory, and is so arranged that any machine may be connected in a few minutes to any other or to any room in the building.

The dynamos are all driven by motors fed from the Corporation mains, the wires being carried overhead so as to be completely removed from the wires used in connection with the experimental machinery, which are laid in troughs cut in the floor. The room also contains several experimental dynamos and motors, both for direct and alternating currents, which are placed in the two bays mentioned above.

Several machines are lent for experimental work—the test results being forwarded to the makers or owners for inspection. By this means the experimental equipment of the laboratories is increased, and the owners obtain much valuable and detailed knowledge of the behaviour of the machines which they ordinarily use.

Among other dynamos are three-phase, two-phase, and single-phase generators, with corresponding induction motors which may be driven by the generators, and several direct-current machines. All the machinery in this laboratory is so arranged as to be availabe for experimental work of all kinds. Except for the driving motors, no elaborate switchboards are used, the necessary connections having to be made by the student.

WORKSHOP AND SENIOR LABORATORY.

Adjacent to this room is the workshop, which contains lathes and planing machines, drills, and other tools, all driven by electricity, and on the same floor, and adjacent to the dynamo-room, is a senior students' laboratory, 34 ft. by 28 ft., equipped for alternating current testing of all kinds. This laboratory contains a considerable number of testing instruments, has two pairs of static transformers and several small isolated machines, on which a large number of tests are carried out. In a hall with roof light is arranged a museum.

In the front part of the basement are placed the laboratories for special experimental purposes. A room of 35 ft. by 13 ft. is fitted with high-tension transformers and other appliances for producing high electrical pressure by which "breakdown" tests on insulating materials (such as are used in the manufacture of high-tension cables) may be made. Adjacent is a room containing a number of galvanometers, permeameters, and other apparatus for carrying out complete investigations on the magnetic qualities of iron and steel. Another room contains a photometric bench, and is used by students to find the efficiency of different kinds of electrical lamps, and the consumption of energy required to produce light. Two large rooms, 20 ft. by 27 ft., are available for general research, one of them being occupied at present by a high-frequency oscillograph, with which investigations are being made of various problems relating to loss of energy occurring in different electrical machines. The other research laboratory is intended for electro-chemical work, but at present is without equipment.

TEST AND RESEARCH-ROOMS.

Four other rooms on this floor at present are imperfectly equipped; one containing a number of special accumulators intended for research purposes only, another designed to enable "life" tests to be made continuously on different kinds of electric lamps.

Next to the entrance is the professor's room, with a private research laboratory opening out of it, and a demonstrator's room adjoining. On this floor are arranged the laboratories for the less advanced work; including the apparatus used in making tests on telegraphic cables for faults, and the battery-room.

The arrangement used in the galvanometer room on this floor is modified somewhat from the methods ordinarily employed. The spots of light which are used to observe the motions of the needles of the galvanometers are produced by Nernst lamps; the spots themselves are thrown on to a transparent scale, the illumination being so bright that they may be observed in full daylight. In this way the galvanometers may be used while benches in the same room are being employed for quite different purposes, and the ease of working with the galvanometers is very much increased.

The laboratories have been designed by Messrs. Willink and Thicknesse, architects, of Liverpool; Messrs. William Thornton and Sons, Liverpool, were contractors for the building; and the electrical fittings were supplied by Messrs. John Hunter and Co., Liverpool.

SHIPBUILDING NOTES.

A NEW steamer—the *Agberi*—has been launched for Messrs. Elder, Dempster and Co., by Messrs. Workman, Clark and Co., Ltd., Belfast. She is a sister ship to the *Patani*, which was launched about a month ago from the same yard. Like the *Patani*, she is a vessel of over 3.600 tons gross, and will be employed in the West African coast trade.

Messrs. Workman, Clark and Co., Ltd., Belfast, have launched a new P. and O. steamer, which will be known as the *Delta*. She has a gross tonnage of over 8,000 tons, and has been specially designed for her owners' trade to India and China. The machinery has been constructed by Messrs. Workman, Clark and Co., Ltd., at their Queen's Road Works. It consists of two sets of quadruple expansion engines, having improved auxiliaries with two double-ended and four single-ended steel multitubular boilers.

On Tuesday, July 4th, the large steel screw steamer *Kirnwood*, built by R. Craggs and Sons, Ltd., Tees Dockyard, Middlesbrough, for the Constantine and Pickering Steamship Company, of Middlesbrough, proceeded to sea for her official trials. The results were pronounced entirely satisfactory to all concerned, the vessel registering a speed of 11¾ knots. The machinery has been fitted by Messrs. Blair and Co., Ltd., of Stockton-on-Tees, having cylinders 23½, 39, 64, by 42 in. stroke, steam being supplied by two large single ended boilers working at 160 lb. pressure to the square inch.

On the 4th inst., Messrs. Ropner and Sons, Stockton-on-Tees, launched from their yard a steel screw steamer of the following dimensions: length, 366 ft.; breadth, 53 ft.; depth, 30 ft. 4 in. The vessel has been built to the order of Messrs. R. Ropner and Co., West Hartlepool, and is fitted with the builder's patent improved trunk deck. The deadweight carrying capacity will be about 7,200 tons on Lloyd's summer freeboard.

There was launched from the shipyard of Messrs. Cochrane and Sons, shipbuilders, Selby, on Tuesday, the 4th inst., a handsomely modelled steel screw trawler, the principal dimensions being 117 ft. by 21 ft. 6 in. by 11 ft. 9 in. depth of hold. The vessel has been built to the order of J. L. Green, Esq., of Grimsby, and will be fitted with powerful triple expansion engines, by Messrs. C. D. Holmes and Co., of Hull.

The *William E. Cory* just launched at the South Chicago yards of the American Shipbuilding Company, for the Pittsburg Steamship Company, will be one of the four largest vessels on the Great Lakes. The latter company is one of the subsidiary companies of the United States Steel Corporation, after whose president, Mr. William E. Cory, the new vessel is named. At the launch the steel corporation was represented by its first vice president—Mr. James Gayley. According to the Iron Age, the *Cory* and her sister ships offer further testimony to the originality of design now making the evolution of shipbuilding on the lakes. They are in a number of features unlike any ships built or building. In the first place they are the longest on the lakes, being 9 ft. longer than the *Augustus B. Wolvin*, or 569 ft. over all, 549 ft. keel, 56 ft. beam, and 31 ft. deep. While the general principle of construction is the same as their predecessors in the absence of stanchions and stringers or any interference below deck with the unloading machines, the vessels are not of arch construction. Mr. Coulby, after consulting a number of authorities concluded that an arch was primarily intended to support weight from the top and that a more rigid longitudinal construction could be secured by a straight girder across the deck.

The construction of the cargo-hold also is a departure from anything at present on the lakes. The cargo hold descends in a straight line from the deck until within 9 ft. of the tank top when an inner hold or hopper is constructed 9 ft. from the skin of the ship and descends to the tank top. The top of the hopper is joined to the skin of the ship by an incline construction, thus avoiding what would otherwise constitute a shelf and also preventing any lodgment of ore. The water bottom is 5 ft. 6 in. deep and is used for water ballast in conjunction with a 9 in. space formed by the hopper and the sides of the ship. This construction gives enormous water ballast capacity, approximating 8,500 tons, making the steamer navigable in all sorts of weather and providing extraordinary rigidity in the longtitudinal section.

These ships are designed for a carrying capacity of 10,000 tons, but favoured with deep draught their actual cargoes are likely to be considerably in excess of this figure. The engines are triple expansion with cylinders 24 in., 39 in., and 65 in. diameter by 42 in. stroke, supplied with steam from two Scotch boilers, 15 ft. 4½ in. diameter by 11 ft. 6 in. long, fitted with Ellis and Eaves induced draft and allowed 170 lb. pressure.

THE THREE-PHASE 40,000-VOLT POWER TRANSMISSION FROM GROMO TO NEMBRO (LOMBARDIA).

(*Continued from page* 13.)

SWITCH GEAR.

THE 4,000-volt conductors as also the exciting leads for the generators and the exciter leads themselves are all placed in one common trench, under the engine-room floor and leading into the basement. The second room has been entirely taken up by the bus-bars and the tension transformers connected to same.

The third storey has been reserved for the lightning arresters and the leading-out arrangements of the line.

Each generator has its own framework for carrying the following apparatus; three high-tension single-pole removable tube type fuses with blow out horn, one potential transformer with fuses and two current transformers.

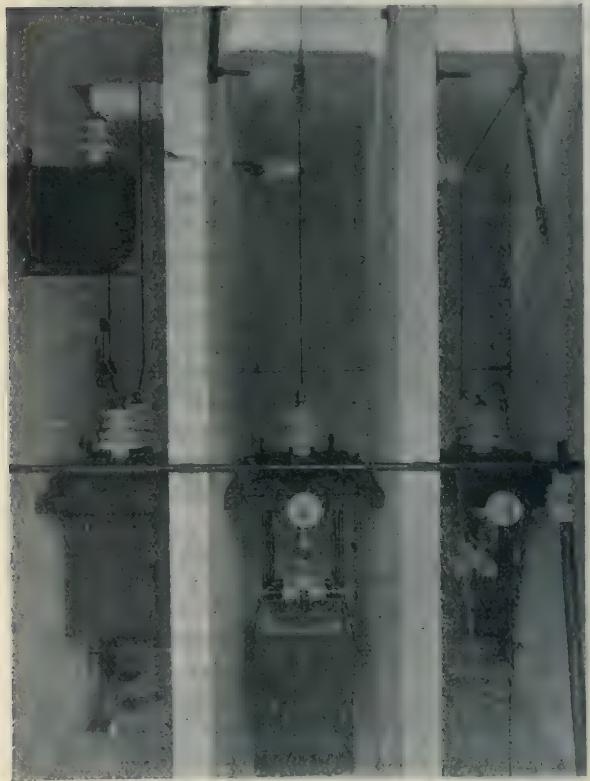


FIG. 5. FRONT VIEW OF AUTOMATIC HIGH TENSION SWITCHES.

The framework is a riveted structure completely made of iron, the lateral sides covered with embossed sheeting. At the front removable shields have been provided in order to enable renewal of the fuses or inspection of same when necessary. The leads enter the transformer room through thick glass tubes cemented into the dividing wall.

In laying out the 40,000-volt apparatus, the extra high tension bus-bars were taken as the starting point. So as to exclude all possibility of arcs being formed between bars of different polarity, each phase was enclosed into a separate cell made of incombustible material. The thickness of the walls of these cells is 120 millimetres (see fig. 1 and 9). Great care was taken in obtaining a mechanically strong and at the same time electrically efficient insulator. The ordinary type on the market proved unsuitable, and a special type was therefore designed to meet the circumstances. This insulator consists of three parts, baked separately but glazed together. The main body of the insulator has four deep grooves. Each insulator had to withstand a test of 100,000 volts before being delivered.

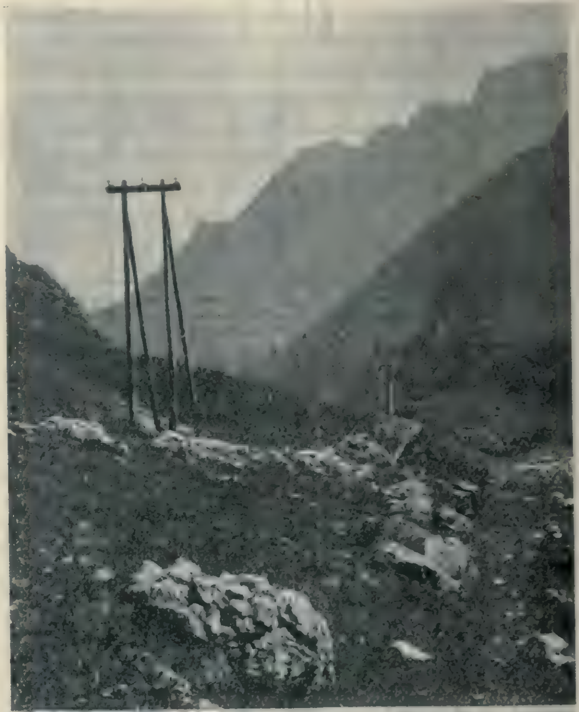
Immediately below the extra high tension bus-bars on the first floor, the high-tension oil switches have been erected. To avoid getting heavy apparatus, each phase was equipped with a separate switch. The three elements are however, operated simultaneously.

A similar structure was adopted for carrying the switches as that for the bus-bars, and each switch was separated from its neighbour by a wall of 120 millimetres in thickness. The brackets and supports for the switches have been cemented into this wall. In this way each switch is placed in a fireproof cell of 600 millimetres width. Through an aperture at the top, the connections pass from the switches to the bus-bars. Removable disconnectors have also here been provided which permit one to isolate any of the cells, when same have to be switched out of circuit, to be cleaned or inspected.

The switches are of the multiple brake type. Both the moving and stationary contacts, as well as the mechanism, are immerged in an oil bath, so that nothing appears above the surface of the oil but insulating material and earthed parts of the apparatus.

The oil reservoirs are quickly and easily lowered for getting at the contacts. All current carrying parts have been solidly constructed and are of ample cross section. To preserve the main contacts, little auxiliary ones have been provided which carry the current when the main contacts have already been separated, and so take up the harmful effect of the arc. These contacts are easily renewable. To make sure that the spark produced when breaking the current is destroyed the contacts have been formed in such a way that on the moment of rupture a volume of oil is forcibly thrown against them.

In order to weaken the destructive effect of the spark, the circuit is simultaneously broken in six places. In doing this a small travel for the moving contacts can be allowed. This travel in the present case amounts to 8 centimetres, thus giving an effective oil break of 35 centimetres after having subtracted the overlap of the contacts. This break ought certainly to be more than sufficient even for a tension of 40,000 volts. Moreover, the fact must not be overlooked, that in three-phase working, two phases have to be considered as forming one circuit, thus giving twelve simultaneous interruptions per phase. Although for reasons mentioned, this switch was composed of three single pole elements, the firm's usual practice



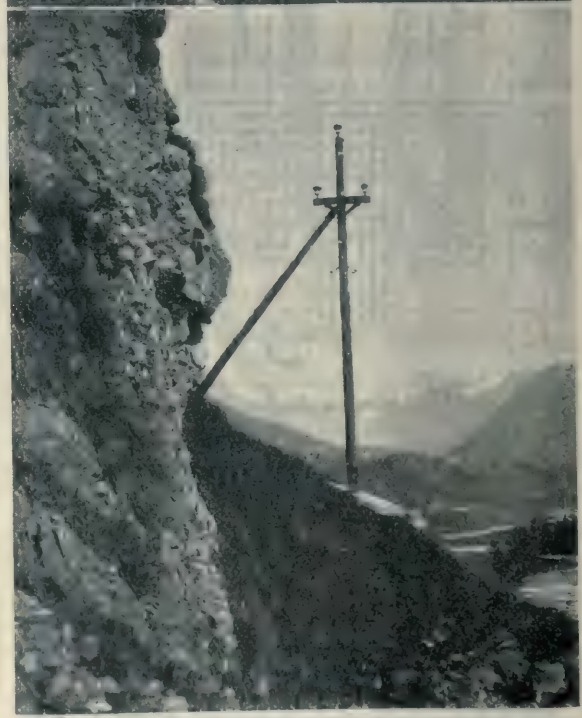


FIG. 6. 145° ANGLE AT THE DEL COSTONE BRIDGE
FIG. 7. CURVE AT THE DEL RISO BRIDGE.

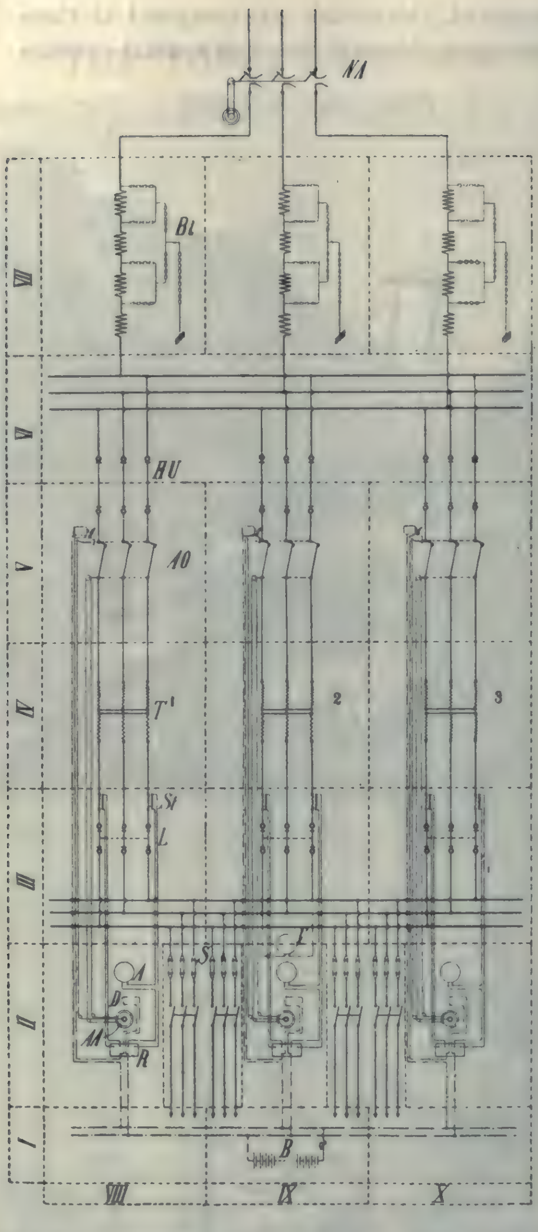


FIG 8. DIAGRAM OF CONNECTIONS IN THE NEMBRO TRANSFORMER STATION.

I III—Room for the 500 v. low tension apparatus; II—Room for the switchboard; IV—Transformer compartment; V—Switch compartment; VI—Room for the bus-bars; VII—Room for the lightning arresters; $_1$T—Transformer 1; ^{2}T—Transformer 2; $_3$T—Transformer 3; A—Amperemetre; V—Voltmetre; R—Relay; B—Accumulator battery; L—Disconnector for the low tension; St—Current transformer; S—Fuses; D—Contact; NA—Safety switch; AO—Automatic oil switch; AA—Driving spindle for the switch; HU—Disconnector for high tension; Bl—Lightning arresters.

is to combine them into one apparatus. The oil baths, are however, kept separate, i.e. one for each phase.

The generator board is built in the form of a desk, the top part inclining towards the operator. This inclining portion is made of cast iron and the measuring instruments are let in beneath its surface. The board is placed in the gallery giving access to the engine room, so that the attendant can survey the whole of the machinery and at the same time have his hands close to the controlling apparatus. The operating board is only equipped with low-tension apparatus, and consists of three generator panels, one feeder panel and one exciter panel.

It may be of interest to English switchboard manufacturers to note that no marble or slate was used in the construction. The vertical sides of the boards are covered with ornamental embossed iron sheeting. A bus-bar voltmetre is mounted on a bracket placed in a prominent position in the middle of the board. The regulating rheostat, placed directly beneath the operating board can be inspected without running any risk when the station is in full swing.

The third story has been reserved for the lightning arresters, each phase separated from one another by a partition. These arresters are of the well-known Wurtz type and are insulated from earth by several porcelain insulators.

TRANSMISSION LINE.

The line consists of three high conducting bare copper wires of 6·5 millimetres diameter, each mounted on Delta insulators supplied by the Hermsdorf earthenware factory. These insulators which are protected by patent are of a new design specially got out for this installation.

They are fixed on wood poles and cross-pieces. As a rule the lines are mounted on a single pole in the form of a triangle with 850 millimetres side. (See fig. 7.) The standard height of pole is eight metres above the ground (nine metres at crossings). The lower insulators are placed at a height of 7·5 metres above the ground (8·5 metres at crossings). Where great spans and sharp bends occur, two poles have been erected and the insulators mounted on the cross beam at a distance of 1,000 millimetres from centre to centre. The largest span is 120 metres (this considerably exceeds the requirements of the Board of Trade in England) and the sharpest angle 145 deg. At San Carlo the line crosses an existing single-phase line of 2,000 volts and at Albino a line and a canal. The average length of span from pole to pole is 40 metres.

TRANSFORMER STATION AT NEMBRO.

The transformer station is situated at Nembro in close proximity to the factory. The line enters the building at a tension of 38,000 volts, this being the voltage to which Gromo have to regulate their hydro-electric transformer units.

The Gromo transmission plant was officially started on July 11th, 1904, and the results obtained up to now have been beyond expectation; both as regards satisfactory running and reliability of the supply.

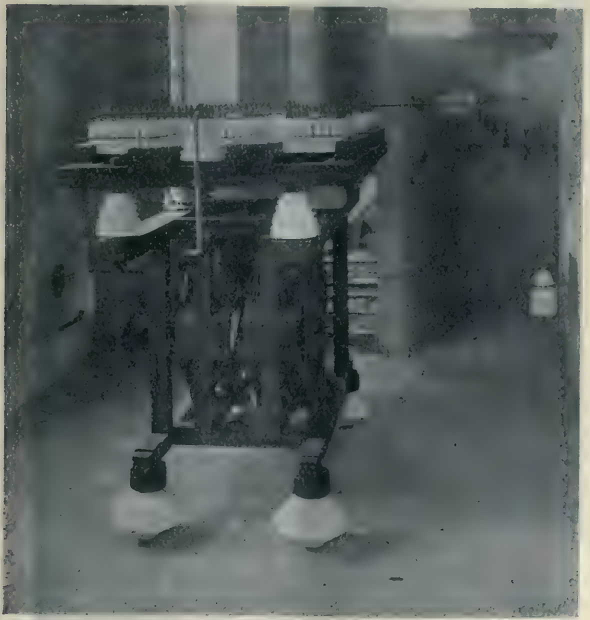


FIG. 9. LIGHTNING ARRESTERS AND 40,000-VOLT BUS-BARS.

OPENINGS FOR TRADE ABROAD.

Belgium.

The "Société Nationale des Chemins de Fer Vicinaux," invite tenders for railway plant, which will be opened (1) on August 2nd for the construction of the sections Brecht to Oostmalle and Oostmalle to Herenthals of the local line Brasschaet-Brecht-Westerloo, at the estimated cost of £10,733: a deposit of £1,080 is required to qualify any tender; (2) on August 9th for the construction of the local line Turnhout to Poppel (frontier) at the estimated cost of £5,780; deposit, £560; (3) on August 16th for the construction to Turnhout of the local line Malines-Itegem-Westerloo-Gheel, at the estimated cost of £4,582; deposit, £440. Tenders should be addressed to the general manager of the company, 14, Rue de la Science, Brussels, from whom copies of the specifications may be obtained.

Mexico.

A concession has been granted to Senor T. Garcia for the construction and working, for 99 years, of a railway, 914 millimetres gauge from San Juan de las Huertas to Zacualpan, State of Mexico, passing through Temascaltapec, or Texcaltitlán and Sultepec. Five years are allowed for the free importation of materials and goods referred to in Article 74 of the Railway Law.

Sweden.

A recent Consular report from Stockholm points out that during the past year the use of motors, gas, gasoline and oil engines has increased considerably in Sweden, and interest and confidence in them are growing steadily. It is evident that there is a wide field for these motors, especially where small power is needed. Of gas engines, the suction gas variety seems to take the first place, and is generally used in sizes of up to about 100 horse-power. They are mostly used in factories, and for electric power stations, but are also used for boats. The majority have till now been imported from the United Kingdom and Germany, but the home manufacture is increasing. They are, without exception, of the four-cycle type.

Gasoline or benzine motors are mostly of small sizes, such as 3, 5 or 7 h.p. They rarely exceed 40 h.p. They are principally used in motor-cars and pleasure boats. These motors are likewise of the four-cycle type. Oil engines are to be found of all sizes from 1 up to 200 h.p. These engines are by far the most important, and there are indications that their use will be very extensive. This is the case especially as regards fishing boats and smaller freight craft. On account of its simple construction, as well as the ease with which ordinary people learn to handle it, the two-cycle type has been favourably received in both agricultural and small industrial circles.

IRON ORE DEPOSITS ABROAD.

POSSIBLE FIELDS FOR FUTURE ENTERPRISE.

A VERY useful report, replete with information on the subject of iron ore deposits in foreign countries, has been compiled in the Commercial Intelligence Branch of the Board of Trade from information collected by H.M. Diplomatic and Consular Offices.* It is the outcome of an inquiry undertaken in consequence of representations received by the Board of Trade from the British Iron Trade Association. As a basis of inquiry a number of practical questions were submitted, one of the most important seeking information as to whether the proprietors of the deposits described would be likely to be sellers on reasonable terms. A report consisting almost wholly of detailed replies to specific questions does not lend itself to the purposes of a summary, but in glancing through this suggestive compilation we propose to set down a few of the more interesting details.

AUSTRIA-HUNGARY.

Bohemia is particularly rich in iron ore deposits, and they are to be met with in all parts of the kingdom. These ores occur in primary rocks, in transition rock, as also in more recent formations, and are found in beds, lodes, masses and accumulated veins. The silurian strata are the richest in ores. The iron ore deposits in Bohemia consist for the most part of dense and lenticular granular red ores, which are frequently to be met with in such abundance that, although they have been worked for centuries, the supply is assumed to be practically inexhaustible. The yield of the Bohemian ore varies from 25 to 50 per cent. and over. In some parts of the country, particularly in the district of Budweis, the mines are greatly scattered. The lodes are intermissive and not of great thickness, and moreover, the means of communication between the mines and the smelting works are inadequate.

Attention is drawn to various mines which have ceased to be worked on account of the scarcity of wood for fuel for smelting purposes, and to these might be added many others which, on account of the existing commercial depression, could now be purchased far below their real value.

In the east of Bohemia iron mining up to the year 1876 was not of importance, and in that year ceased entirely in consequence of the lack of communication. The nearest railway station to the mines was Kuttenberg, on the N.W. Railway, 40 kilometres distant A local railway line has now been built leading direct to the mining district, and was completed on August 1st, 1903. This will now enable the excellent magnetic iron ore lode on Mount Fidnik to be worked. The many small heaps and sinkings show that magnetic iron ore was obtained by open workings, which only reached a depth of from 20 to 25 metres below the surface, the bulk of the lode lying deeper, not having, as yet, been touched. The N.W. Railway having now brought its line to Hammerstadt in the immediate vicinity of the mines, the greatest obstacle to their further development has been removed. For this purpose little capital would be required, as the strong current of the Sazava would be utilised, and the whole layer could be worked by a short and cheap shaft of 150 to 200 metres.

Numerous deposits of iron ore exist within the Consular district of Bosnia and the Herzegovina. The deposits are in the districts of Banjaluka, Prijedor, Sanskimost and Kostajnica, in the north-west of Bosnia, and in the districts of Fojnica and Visoko, in the south of Bosnia, but by far the most extended deposit is at Vares, in the district of Visoko. The ore at the last-mentioned place is chiefly red hematite, with a substratum of sparry iron, and yields from 55 to 65 per cent. pure iron. The deposit is estimated at not less than 25,000,000 tons. The nearest port of shipping to the deposits in the north-west of Bosnia, capable of admitting ocean steamers, would be either Fiume or Trieste, which are respectively about 250 and 290 miles distant by rail; whereas the nearest port to the deposits in the south of Bosnia is Gravosa, which is 208 miles by rail from Vares. The chief deposits belong to the State, and mining concessions can be obtained on reasonable terms. Deposits in the hands of companies or private individuals are mostly so under concessions from the Provincial Government, but for want of sufficient capital are little worked, and the concessions could probably be taken over on favourable terms. The only deposits extensively worked are those in the neighbourhood of Vares.

---

* Obtainable from Messrs. Wyman and Sons. Price 2s. 4d.

FRANCE.

In the Departments of Dordogne and Ariège considerable deposits of iron ore are known to exist, especially in Ariège, where there are millions of tons of good material. The nearest shipping port is Bordeaux, where ocean steamers can approach, and the distance is about 340 kilometres from the Ariège. The ore of the Dordogne Department is a silicious one, but free from phosphorus, and contains a high percentage of pure iron. The iron ore from the Department of the Ariège gives a lower percentage of iron. Some of the deposits are being worked, but the ore is only sold to the Ariège furnaces; no mineral has been exported, as the existing mines have not been properly worked, and scarcely any capital spent in developing the rich deposits.

In the Forêt de Paimpont, near Rennes, there was raised in 1902 about 3,500 tons; in 1903 about 9,000; the working firm stating, that in 1904 they expected to ship at least 20,000 tons. All the shipments have gone to the United Kingdom, with the exception of a small quantity to Boulogne-sur-Mer and Rotterdam; Grangemouth, Ardrossan, and Cardiff (the latter only one cargo), being the ports of destination.

The owners of the forest are very wealthy business men, of Nantes, but probably open to sell concessions as they have already done to the present working firm.

The Consul refers to the dislike of any foreign element in the trade of the country, which most of those taking up trade in France find, both with the workpeople and the commercial people.

The deposits of iron ore in the Havre district are very extensive. Workings have been discovered dating back to the time of the Romans. The deposits extend from six miles south of Caen to the limits of the Department of Calvados to the south and west. Thirteen mining concessions have been granted of over seventeen thousand acres in extent.

The chief obstacles to the full working of these, apparently, very valuable deposits, are, the Consul is informed, shyness on the part of local capitalists, the difficulty of access to the railways from some of the properties, and the low grade of some of the ore, which would not bear the cost of transport to the distant blast furnaces. The deposits in question vary in richness from 50 to 55 per cent. in the hematite, to 38 or 40 per cent. in the carbonate, the latter forming, it is said, the principal part of the whole. To make the transport of this low-grade ore profitable, it would have to be calcined. Mr. Frank Lethbridge, British Vice-Consul at Caen, thinks that a company with a capital, say, of eight hundred thousand pounds might be able to buy up the most valuable concessions, and, if they were to build large iron works, they would do a very profitable business.

The iron ore in the Ariège, Toulouse, gives about 55 per cent. metal, 0·15 per cent. sulphur, and 0·012 per cent. phosphorus; all the ore is consumed on the spot, and there is an active and continuous output.

None of the deposits have been worked extensively. The only obstacles up to now have been the cost of transport, the deposits being generally situated in high altitudes, requiring putting up of cables, expenses which the present owners have shrunk from incurring, but which would be very feasible with a powerful organisation of capital.

Andorra contains enormous deposits of excellent iron ore, which is situated in the continuation of the Palleresa chain of iron mountains on Spanish territory, but this great wealth is totally lost to mankind by reason of the absence of all communication. Closely intermingled with these unique iron ore deposits o exceptional quality are the very important coal and lignite deposits, two elements important in the establishment of blast furnaces to make pig iron for Spanish and export purposes. But without a railway it is useless to think of exploiting these rich deposits. Mr. Emile Tuteur has been charged by the authorities of the province of Lerida to procure the capital for this railway (length 156 kilometres).

The Consul adds: There is an enormous supply of iron ore for many years, I am told by competent persons. From what I can learn there are many annoying formalities to be feared from the French authorities, such, for instance, as the necessity of getting permission to sell iron when once procured, but these difficulties can be overcome by persons properly initiated. Another difficulty would be in the supply of coal, which is charged ten francs per ton freight, but doubtless special conditions might be obtained if applied for in an intelligent way.

It appears to the Consul that persons sent out from the United Kingdom without knowledge of the language, country or local customs and laws, would probably fail to succeed in their mission, if not ably seconded in their efforts by someone who knows and lives in the country.

(To be continued.)

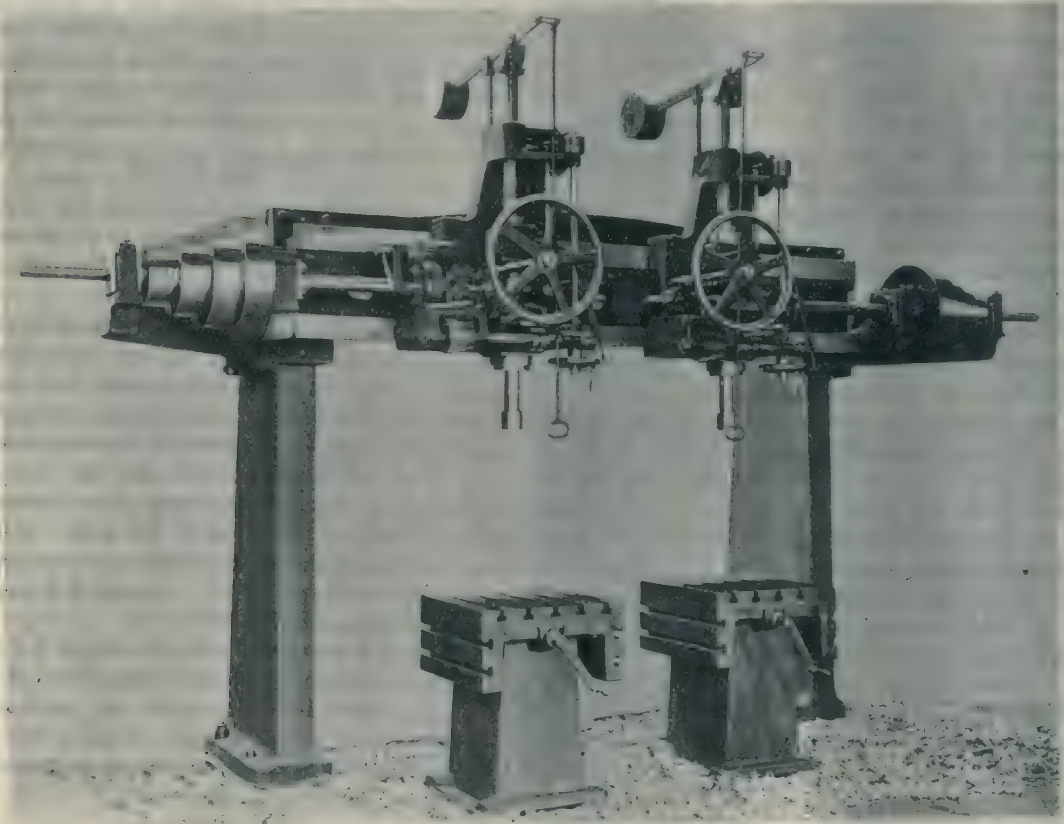
A SPECIAL MULTIPLE DRILLING MACHINE.

BY GEORGE SWIFT, CLAREMONT IRONWORKS, HALIFAX.

TWO machines have been made of the type illustrated, and are designed for high speed drilling. The machines themselves are fixed on two standards, which are tied together by 2-in. bolts, passing through lugs cast on the standard below the floor level, and these are again bolted on to a heavy foundation plate which the owner is making himself, the tables also being put on the foundation so as to make the whole firm and rigid.

On the standards the cross slide which carries the two saddles is bolted, also the two cone brackets, one for each spindle, so that either spindle can be run independently of the other. The first saddle is double geared, and the second one is single geared, but has reversing motion to spindle for tapping. The sizes of the holes to be bored are 2½ in. diameter and 1 in. diameter, respectively, and 1 in. holes have to be bored in mild steel at the rate of 10 in. per minute. The 2½ in. diameter holes are to be bored at a proportionate speed.

There are three feeds to each spindle, of the geared type, so as to be positive and any of the feeds can be obtained instantly. The spindle is 2½ in. diameter, with 14 in. self-acting feed, and balanced spindle and quick withdrawal motion, so that the spindle can instantly be brought to any position. The whole of the bearings are of exceptionally large diameter and long, fitted with adjustable brasses, so that there



SPECIAL HIGH-SPEED DRILLING MACHINE, BY GEORGE SWIFT, HALIFAX.

is ample room for adjustment should any wear occur as is common with machines always running at very high speeds. The saddles can be worked along the cross slide by means of rack and pinion to any desired position. The tables have a movement of 12 in. transversly, enabling holes to be drilled on any part of the table. The whole is complete with countershaft for each spindle.

The leading dimensions are as follows: Distance between standards, 8 ft. 2 in.; distance from face of cross-slide to centre of spindle, 12¾ in.; maximum centres, 6 ft. 3 in.; minimum centres, 2 ft. 10 in. Takes under spindle and floor 5 ft. 2 in.; under spindle and top of table, 2 ft. 8 in; table 24 in. square by 12 in. deep; total height of table 2 ft. 6 in. Spindle 2½ in. diameter by 14 in. feed. Four speed cone 18 in. diameter for 4 in. belt. Pulleys 20 in. diameter by 4 in. belt. Cross slide, 17½ in. wide on face. Overall dimensions, 19 ft. long by 5 ft. 9 in. wide by 11 ft. 4 in. high. Net weight of each machine, six tons.

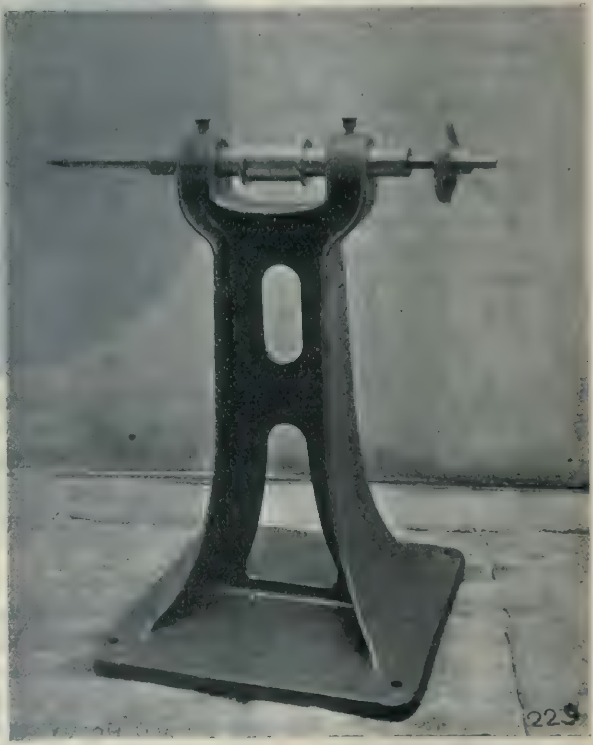
INSTITUTION OF NAVAL ARCHITECTS.

THE summer meeting of the Institution of Naval Architects is to be held in London on July 19th, 20th and 21st. The formal business, and the reading of papers and the discussions will take place in the hall of the Society of Arts, which is the usual locale of the Institution for meetings in the metropolis. Among the papers to be read and dicussed are "Classification of Merchant Shipping, illustrated by a short history of Lloyd's Register," by Mr. H. J. Cornish; "Experiments with Models of Constant Length and Form of Cross Sections, but with varying Breadth and Draughts," by Lieut.-Colonel B. Rota; "On the Effect of Depth of Water on Speed," by Mr. Harold Yarrow and Mr. N. W. Marriner; on "The Failure of Some Large Boiler Plates," by Mr. J. T. Milton; and "A Comparison of Performances of Turbines and Reciprocating Engines on the Midland Railway Company's Steamers," by Mr. William Gray.

Among the excursions arranged are visits to Portsmouth Dockyard, Messrs. Siemens Bros. and Co.'s telegraph cable works, Messrs. Vickers, Sons and Maxim's Erith Ordnance Works, and Messrs. J. and E. Hall's works. The programme also notifies a visit to the P. and O. steamer *India*, H.M.S. *Black Prince* now fitting out in the Victoria Dock; and to the works of Messrs. Yarrow and Thornycroft. The social events include a conversazione at the Royal United Service Institution, and a luncheon on board the *India*, at Tilbury Docks.

IMPROVED POLISHING MACHINE.

OUR illustration shows the latest form of polishing machine by Messrs. Luke and Spencer, Ltd., of Broadheath, near Manchester. Its distinguishing feature is the introduction of white metal bushings, which replace the ordinary split bearings, with loose caps and help to lower the cost of the machine. The body is bored on the top to take two long cast-iron bushes, into which the white metal is run. Each bearing is held in place by a set screw, and the design now offered, besides being cheaper, has another advantage, for replacement of worn bearings is quite a simple matter, it being only necessary to re-run the bushes with white metal. Cooler running is also claimed. The steel spindles themselves are of four forms, only one of which is illustrated. The spindles necessarily vary according to the polishing buffs, wheels, etc., they have to carry. Between the bearings of the machine either a single pulley or a fast-and-loose pulley may be fitted, as desired. Stauffer lubricators have been found best for this work. The machines are made in three sizes.



AN IMPROVED POLISHING MACHINE BY LUKE AND SPENCER, LTD.

OUR WEEKLY BIOGRAPHY.

SIR E. LEADER WILLIAMS, K.B.

INSEPARABLY associated with the construction of that gigantic enterprise, the Manchester Ship Canal, is the name of Sir Leader Williams, who was responsbile for the plans, and during the progress of the scheme acted as chief engineer. Born at Worcester in 1828, it may be said of him that he follows an hereditary profession; he gained his first experience when his father was engineer to the Commissioners who had obtained powers to improve the navigation of the River Severn between Gloucester and Stourport. These works, which consisted of the construction of locks and weirs, with dredging and embankments, enabled a large class of vessel to use the river.

SIR E. LEADER WILLIAMS, K.B.

After gaining experience in railway construction on the Great Northern line between 1847 and 1850, he was appointed engineer to carry out the work of the lock, canal, and basin which extended the harbour of Shoreham. On the completion of this work he was engaged at the new Admiralty pier at Dover until 1856, when he was appointed engineer to the River Weaver trustees. Under his designs and supervision, important works were constructed which have made this river one of the finest inland navigations in England. The barges which formerly used to carry salt from the Cheshire salt districts are now replaced by steamers carrying 200 to 300 tons, also towing other similar cargoes, all of which pass through the large docks together.

A vertical lift at Anderton, near Northwich, which raises boats from the Weaver to the Trent and Mersey canal, was introduced by Sir Leader Williams to obviate the loss of water to the canal if locks had been adopted to overcome the difference of level, which exceeds fifty feet. This was the first large vertical canal lift constructed.

In 1872 Sir Leader Williams accepted the position of engineer to the Mersey and Irwell and Bridgwater Navigations, on which he introduced steam towing, much to the advantage of the traffic, which maintained a successful competition with the railways.

In 1882 the question of constructing a ship canal to Manchester was being considered, and Sir Leader Williams was instructed to report on the subject. He advised the adoption of locks in preference to a tidal scheme throughout, which had been proposed; his plans were approved, and application was made to Parliament in 1883 for powers to carry out the work. It was strongly opposed by Liverpool, and the railway companies, and the application failed, for after passing the House of Commons it was thrown out by the House of Lords. Another Bill was presented in 1884, alterations having been made to meet the objections raised by opponents, and, as will be remembered, the Bill was then passed by the House of Lords and rejected by the House of Commons. The promoters again presented the Bill in 1885, when it was passed by both Houses.

Difficulties arose in raising the large amount of capital required, and the work was not commenced until 1888; the formal opening of the canal by Her Majesty Queen Victoria took place on May 21st, 1894, but the canal was opened for trade on January 1st of that year.

One of the most interesting works on the canal is the swing aqueduct at Barton, where the Bridgwater canal passes over the Ship canal. Brindleys stone aqueduct was the first canal aqueduct in this country; this had to be removed to make way for the first swing aqueduct which, while facilitating the progress of ships also prevented a loss of water to the Bridgwater canal.

Sir Leader Williams, who is a member of the Institution of Civil Engineeers, was elected a member of the council in 1895, and he was recently made a vice-president

THE FUTURE OF MARINE GAS ENGINES.

BY PETER EYERMANN.

THE use of gas producers for boats has, I believe, received attention since the earliest days of gas engine building, but there have not been any very important developments along this line, and large gas engines for this purpose have not as yet been built. It appears that one of the principal reasons why the gas engine has not come into more general use is the uncertainty as to the question of reversibility.

It has been held that engines of this type, having a capacity of more than 100 h.p., are impracticable, it having been shown that as compared with the ordinary steam engine, they are subject to much greater vibration, have much more weight in themselves, besides the heavy flywheel and gearing, and that the valve and ignitor motions are of a complicated character. Owing to a lack of positive connection between the main engine and propeller shafting, it has been considered doubtful whether large gas engines would ever be available for use on board ships of the navy. The development of the large engine using a very poor lean gas has been such that I believe the builders of marine engines will be forced to take up this type, as was the case in stationary practice. So much has been written of late concerning the rapid development of this type of motor that I will not dwell upon that point, but would mention the fact that the improvement in the large types has been followed by a corresponding development of the producer, just as in the case of the steam engine where the increasing efficiency demanded better boiler and condensing plants. The best type of gas engine would have no sale if it were not possible to supply a cheap gas of good quality for its operation. The construction of large engines operating with blast-furnace gas having a calorific value of not more than 90 to 100 b.t.u. has led to the development of another type to use producer gas whose value in b.t.u. varies from about 125 to 170.

The accompanying table gives the composition of the above as compared with the rich natural and illuminating gases. The table substantiates the theory and is in keeping with the result of actual practice, where it has been found that the amount of air required for combustion increases with the quantity of combustible gases, and especially with the amount of heavy hydro-carbons in the mixture, and explains why poor gases have been found to give very nearly as much horse-power as stronger ones in cylinders of the same size.

PRODUCER GAS.

It has been demonstrated by special tests as well as in actual practice that, in the case of water-cooled engines, the more nearly instantaneous the combustion the better will be the efficiency obtained. Hydrogen being a highly inflammable and quick-burning gas, is of assistance in this connection. The presence of a certain percentage of free hydrogen is also desirable to insure the proper action of the igniting spark.

Mr. K. Kutzbach, a German engineer, has recently published a very interesting paper in which he shows the influence of steam or vaporised water in gas producers, as follows: A diagram, the one at the left in fig. 1, illustrates the gasifying of carbon with air. The one at the right is a similar diagram, in which steam is used. By connecting the two we obtain a third, a, showing the composition of ordinary producer gas. It will be seen that producer gas consists, essentially, of nitrogen, hydrogen, carbon monoxide, and carbonic acid, and that the percentage of each is dependent upon the others.

The more hydrogen in the gas, the more carbon will be required for its manufacture, and the more expensive it will be; but it will be seen from line b that the number of heat units is increased with the increase of the CO, and hence a better quality of gas is obtained. As stated above, the inflammability is increased by the addition of hydrogen, hence for good gas engine practice, the object should be to obtain a mixture with just enough hydrogen to insure ignition. With the producer, a gas is generally obtained whose composition is represented by that portion of the diagram lying between the lines c and d.

Kind of Gas.	H.	CH_4.	CO.	CO_2.	N.	Combustible parts.	Air required.	B. T. U.
Natural	2.	93.8	0.6	0.6	3.	96.4	8—9	1,100
Illuminating	46.	45.	7.5	1.	0.5	98.5	6—7	700
Coke oven	60.	22.	10.6	3.	4.4	92.5	4—5	450
Water	50.	6.	35.5	3.5	5.	91.5	3—4	350
Producer, bituminous coal	18.	3.	20.	4.	55.	41.	2.	160
anthracite coal	12.	1.	26.	5.	56.	39.	1.5	140
coke	3.	0.6	25.	6.	65.4	28.6	1.	120
Blast-furnace	2.	1.	24.	7.	63.	27.	0.9	100

Blast-furnace gas is nearly an ideal one for gas engines, its composition being principally C O and nitrogen, while water gas is composed principally of C O and hydrogen.

THE QUESTION OF ECONOMY.

Touching now upon the question of economy, which together with that of a reduction of the number of parts, is of most importance on board a man-of-war, it will be noted that in the case of engines operated with producer gas the consumption has already been brought down to $\frac{8}{10}$ of a pound of coal per i.h.p. per hour, which is less than one-half that required for the best steam-engine installations.

As to the steam turbine, which is in much favour just at present, I might add that this type will always require more steam than a good reciprocating steam engine, and it is also a question whether it will be found satisfactory for use at sea in heavy weather. In my opinion it will never come into serious competition with the reciprocating steam or gas engine. The gas turbine might, however, be more highly recommended, as its character is such as to permit of construction in lengths more suitable for marine practice than its steam competitor.

Fig. 2, which represents an average diagram for a non-condensing steam engine, shows an efficiency of 7½ per cent. obtained from the coal in an ideal frictionless machine. Assuming a mechanical efficiency of 80 per cent., this amount is reduced to 6 per cent. The loss in an ordinary boiler may be taken as 30 per cent., with a further loss of 2½ per cent. in the piping and 60 per cent. in the exhaust, thus making the old type of engine a very uneconomical machine. By the selection of a better type of boiler, the use of heaters for the feed water and superheaters for the steam, the boiler loss may be reduced to about 24 per cent., as shown in fig. 3, which represents a good modern condensing steam engine, having a loss of 52 per cent. in the exhaust. For this type the efficiency may reach as high as 22 per cent., from which must be deducted about 4 per cent. for mechanical losses, leaving a maximum efficiency of 18 per cent., a figure which has never yet been reached in marine practice, as the reversible type of engine required for this work cannot equal the best stationary machines.

For comparison with the above, a similar diagram, fig. 4, is given for a "pressure-producer" gas plant. As is generally known, the losses in such a plant are principally in the boiler used to furnish high-pressure steam for the producer and in the scrubber, in which the gas is cooled before going to the holder, from which it passes to the engine. The loss of heat units in the auxiliary boiler is as high as 11 per cent., in the producer about 15½ per cent., in the piping 1 per cent., and 6 per cent. in the scrubber. In a good, modern two-cycle engine there may be carried away in the exhaust as much as 17 per cent. of the heat units, and in the cooling water 19½ per cent., thus leaving for the plant a thermal efficiency of 30 per cent.

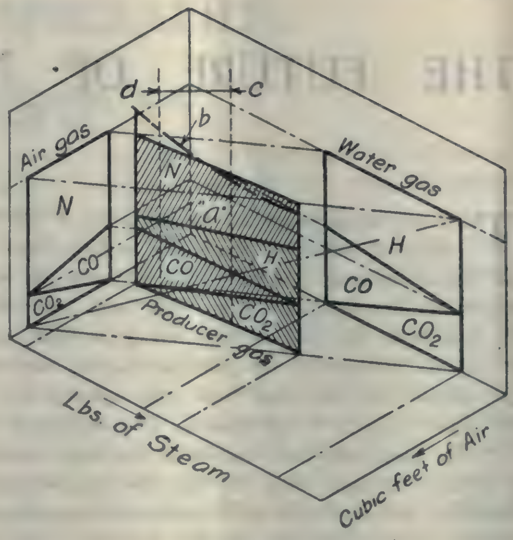


FIG. 1.

ADVANTAGES OF TWO-CYCLE ENGINES.

It will be noted that a four-cycle engine is just as well adapted for use in connection with a pressure-producer plant; but, from my experience with these engines, I would advise the adoption of the two-cycle type for marine purposes, in spite of a possible higher thermal efficiency to be obtained from the other, when used with a suction producer.

In the case of the two-cycle engine there is required an auxiliary compressor plant for the air and gas in which the efficiency loss amounts to about 7½ per cent., thus bringing the total efficiency down to 22½ per cent., as shown in fig. 7.

Fig. 5 is a diagram showing the distribution of thermal units in a modern stationary suction-producer plant of large size. In this case steam of high pressure is not used, but there is a vaporiser in which the loss amounts to 2½ per cent.; the loss in the producer is reduced slightly, amounting to 14 per cent., as compared with 15½ per cent. in the pressure type. With a loss of 7½ per cent. in the piping and scrubber, 19 per cent. in the exhaust, and 22 per cent. in the cooling water, there still remains 35 per cent. of the calorific value of the fuel for the engine; allowing 5 per cent. loss for the engine, we have a b.h.p. efficiency of 30 per cent. In my opinion these figures are such as to warrant the building of marine gas engines.

The following calculation shows the heat-balance scheme for a pressure-producer plant using fuel with a thermal efficiency of approximately 13,100 b.t.u. :—

Coal charged per hour in producer, lb. ..	225
boiler, lb.	25
total, lb.	250
Total heat units charged in plant per hour ..	3,275,000
boiler per hour ..	327,500
furnished by steam per hour	181,600
lost in boiler per hour	145,900
charged in producer per hour	2,947,500
added to producer by steam	181,600
in producer	3,129,100
The gas obtained from the 225 lb. of fuel was approximately 17,000 cubic feet, with a calorific value of 150 b.t.u., thus giving in heat units	2,550,000
Loss in producer was thus	579,100

The efficiency loss in the producer was, then,

$$\frac{579{,}000}{3{,}275{,}000} = 17{\cdot}8 \text{ per cent.}$$

The efficiency loss of the boiler $= \dfrac{579{,}100}{3{,}275{,}000} = 4{\cdot}5$ per cent.

Total loss in plant .. .. = 22·3 per cent.

This may also be arrived at in the following manner: There was obtained per lb. of fuel in the producer 75·6 cubic feet of gas, or in the plant, 68 cubic feet, having a calorific value of 150 b.t.u., thus giving approximately 10,100 b.t.u., whereas the value of the fuel was 13,100 b.t.u., which shows a loss of about 22·2 per cent.

For gas with a value of 140 b.t.u., the efficiency is 72·6 per cent. as compared with 77·8 in the above case.

From figs. 2 to 5 it will be seen that there is no very great difference between a good boiler plant and a good producer plant. The gas engine, however, should be preferred not only on account of its superior economy, but for the reason that it is safer, as in this case we do away with a system of piping carrying steam of a very high and dangerous pressure. The supply of coal is easier in the case of the producer than in that of the boiler, and, as will be seen by comparing figs. 6 and 7, the form of producer is such that it can be installed on board ship without greater difficulty. In fig. 8 is shown the general arrangement proposed for the engine room.

FAIRBANKS-MORSE GASOLINE ENGINE.

In connection with existing installations of small internal-combustion engines, figs. 9 and 10 show the plan and elevation of a Fairbanks-Morse 2-h.p. gasoline

Fig. 2.

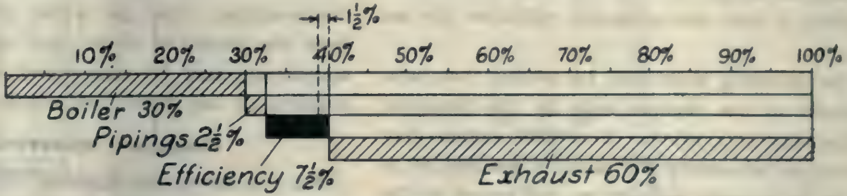


Fig. 3.

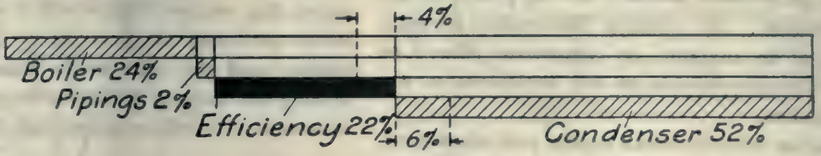


Fig. 4.

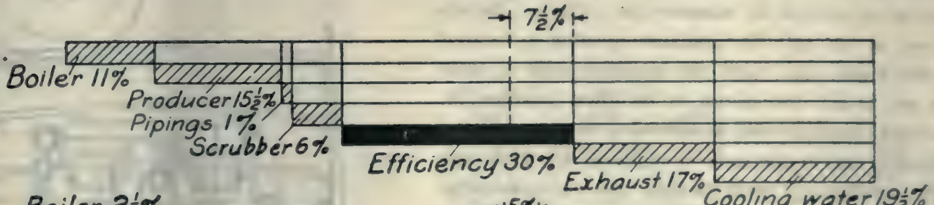
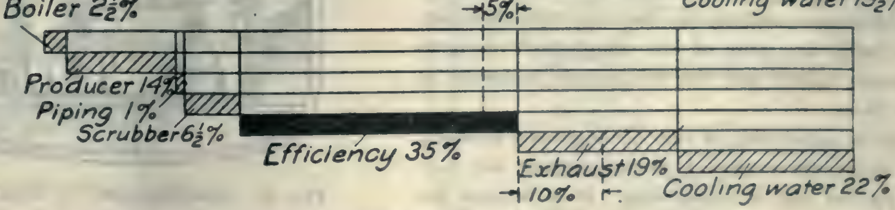
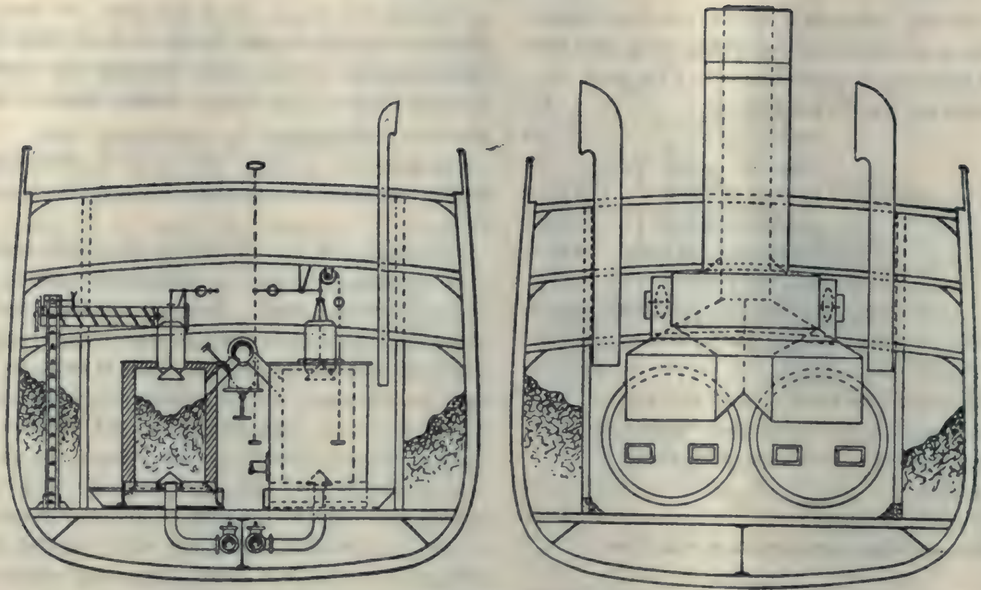


Fig. 5.





FIGS. 6 AND 7. CROSS SECTIONS SHOWING PROPOSED ARRANGEMENT OF PRODUCER ON BOARD SHIP.

engine for a launch, the details of which will be seen in figs. 11 to 13. It is of the two-cycle type, and has the advantage of no valves on the cylinders, a feature which is of such importance that I would propose to accept this general principle for engines of the largest type. There is only one automatic valve for the air suction.

That the reversing shaft may be avoided has been demonstrated in the engines built by the Standard Motor Company and others. A reverse motion may be obtained by advancing the point of ignition so as to give an early back pressure on the piston in the proper direction; by shifting the valve motion; by the use of an auxiliary air compressor plant; or by the proper distribution of the explosives in the various cylinders.

In connection with the small engine just referred to, it may be of interest to examine the cylinder details as shown in fig. 14. The exhaust opening is located near the lower end, with the mixture inlet a little higher up, at a; the piston in its lower position, b, opens the exhaust as well as the inlet, thus scavenging the cylinder and at the same time filling it. This type is very satisfactory even though not so economical as larger engines working on the four-cycle principle, but the latter are more or less complicated owing to the various valves and the mechanism necessary to operate them.

It may be asked why, in view of the greater economy of the four-cycle engine, I should propose the two-cycle type for use on board ship. It is because the production of poor gases can be easily carried out in modern producers and these gases are suitable for this type of engine, while gasoline and such fuels are too expensive for use, and then, in order to save weight, the engines will necessarily have to be made double-acting. The gas under pressure is obtained from the producer direct, and the air required for scavenging may be compressed to the few pounds required by any convenient auxiliary apparatus.

CYLINDER CONSTRUCTION.

Fig. 15 shows the framing drawn to scale for a 10,000 h.p. engine, from which it will be seen that the lower part may be open, as in the case of a steam engine, and the cross-heads, crank-pins, piston and cooling-rod devices, main bearings, etc., will be easily accessible. It will be noted that this engine is of the

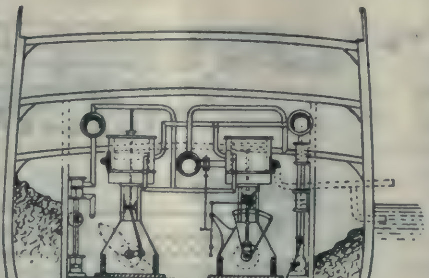


FIG. 8. ARRANGEMENT OF ENGINE-ROOM.

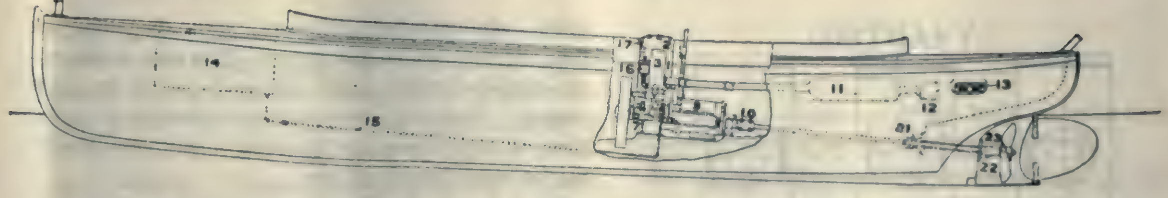


FIG. 9.

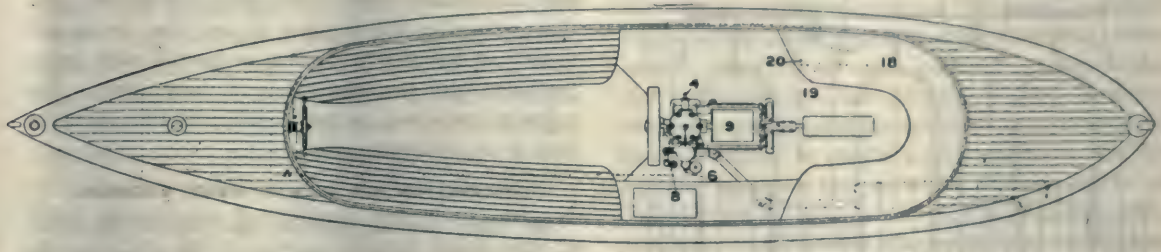


FIG. 10

1. Cylinder.
2. Cylinder Head.
3. Heater.
4. Throttle Valve.
5. Float Reservoir.
6. Oil Valve.
7. Circulating Pump.
8. Sea Cock.
9. Reversing Gear.
10. Coupling.
11. Exhaust Pot.
12. Exhaust Muffler.
13. Exhaust Elbow.
14. Oil Tank.
15. Oil Feed Pipe.
16. Lubricator.
17. Electric Igniter.
18. Battery.
19. Switch.
20. Spark Coil.
21. Inboard Stuffing Box.
22. Outboard Stern Bearing.
23. Propeller Wheel.

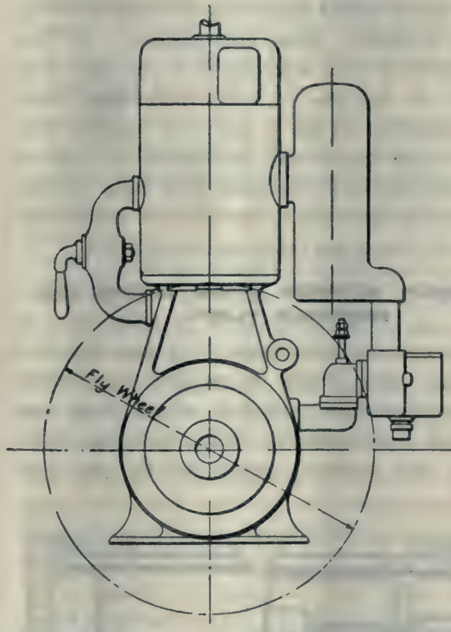


FIG. 11.

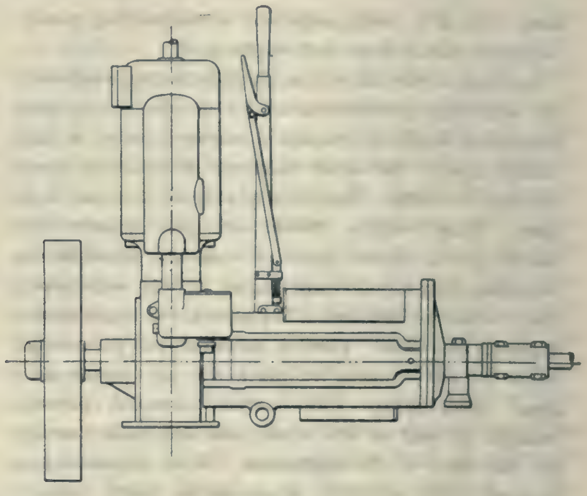


FIG. 12.

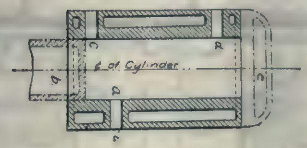


FIG. 14.

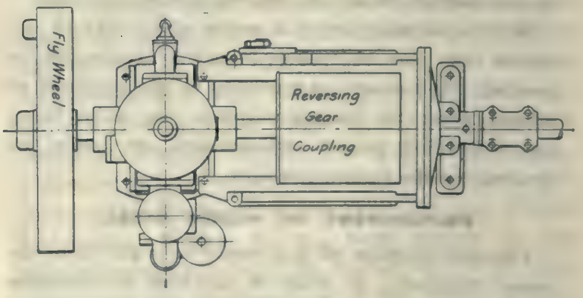


FIG. 13.

DETAILS OF FAIRBANKS-MORSE GASOLINE ENGINE FOR LAUNCH.

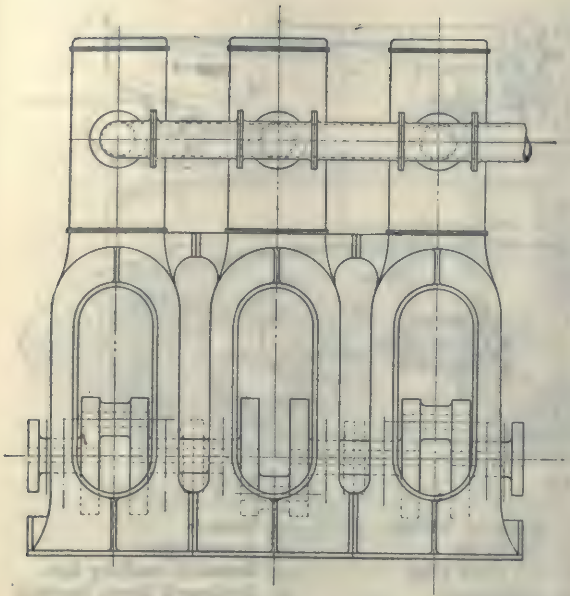


FIG. 15. FRAMING FOR 10,000-H.P. ENGINE.

same size as a steam engine of corresponding power, its height being 36 ft. and length 34 ft.

A proposed method of constructing the large cylinders for such high pressures is shown in fig. 16. A good proportion would be cylinder diameter 60 to 70 in., and stroke 72 in. The exact diameter of cylinders would depend, of course, upon the quality of the gas to be used. With eighty revolutions per minute this would give a piston speed of 960 ft. It should be remarked that for a steam engine of this same power there would be required a low-pressure cylinder with a diameter of 112 in. There is, however, one point which might at first appear to place the gas engine at a great disadvantage; it is the enormous pressure brought to bear on the crank pins and main bearings by the force of the explosions. With a piston area between 2,827 and 4,071 square inches, and a pressure of 400 to 450 lb. per square inch, the resulting pressure on the bearings would be between 580 and 700 tons.

With a plentiful supply of water, which may be obtained from the sea, trouble from this source can be avoided. It will not be necessary to provide fresh or filtered water for cooling purposes, sea water being used, provided proper arrangements are made for cleaning out the various passages.

EMPLOYMENT OF NICKEL STEEL.

The next question of importance is to get rid of the heavy cylinders. If made of cast-iron its thickness would have to be about 4½ or 5 in., and for cast-steel 2½ to 3 in. There can be obtained from existing mills seamless-rolled cylinders, with diameters of 6 ft. and over, in lengths of 10 ft. It is such cylinders, of nickel-steel, that I would propose to use for the large engines. Even if it should be found necessary to make them in two sections, the thickness in such cases would not be more than 1½ to 2 in.

From fig. 16 it will be seen that the openings for inlet and exhaust come at the end of the stroke, when the pressure in the cylinder is very low, being not more than about 60 lb., so that no trouble need be experienced with the connections at these points. The cylinder heads may be tied together by rods, as in the case of an hydraulic press.

UTILISATION OF WASTE HEAT ENGINES.

By using specially-operated gas valves, as shown by the dotted lines in fig. 16, it would be possible to employ air alone for scavenging, and thus effect a saving in fuel.

The gas engine itself will be found heavier than a steam engine of the same power, but as the condensers with their fittings, will not be required, the final result may be an actual saving in weight.

A note might be added concerning the rapid development of the so-called "waste heat engines." It has been demonstrated that a saving of 6 per cent. may be obtained in the case of large condensing steam plants, as indicated on fig. 3, and it is expected that in the case of gas engines this will amount to as much as 10 per cent. (see fig. 5), the waste heat being utilised for the electrical operation of the auxiliary machinery, for heating the vessel and other similar purposes.

COMPARISON BETWEEN STEAM ENGINE AND PRODUCER PLANT.

In a steam-engine installation of 10,000 h.p. it is probable that there would be installed five boilers, each with a capacity of 2,000 h.p., which, in the case of cylindrical boilers, would weigh, including water, smokepipes and fittings, about 220 lb. per h.p.,

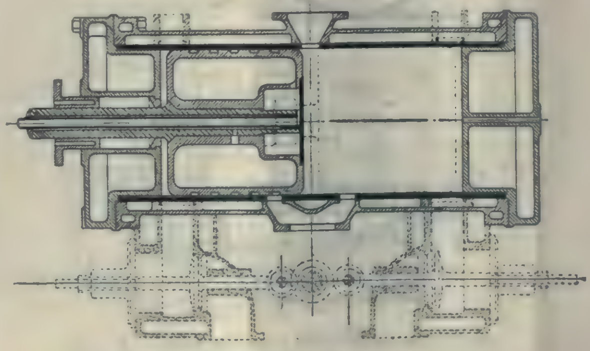


FIG. 16. PROPOSED CYLINDER CONSTRUCTION.

though in the case of certain types, such as that invented by Professor Schutte, of Dantzig, this weight has been reduced to 150 lb. Taking 200 lb. as an average there would then be for a steam plant a total of 2,000,000 lb., or 1,000 short tons, in addition to the engine weights. The grate area would amount to about 750 square feet, and the floor space required would be about 1,500 square feet.

For a producer plant it is safe to count on 10 square inches of grate per h.p., though this may, in large installations, be reduced to 8 square inches or even less, thus giving a total of 700 square feet. For a continuous supply of gas of a good quality it would be advisable to divide the plant into a number of small units. I would propose that ten producers, each with a capacity of 1,000 h.p. and 70 square feet of grate area, be adopted. The inside diameter of each would then be about 10 ft., which would correspond to an outside diameter of 12 ft., and would require for the whole plant a floor space of 1,140 square feet, as compared with 1,500 in the case of the boilers.

As to the question of weight, this is also in favour of the producers; each would weigh about 125,000 lb., of which amount 77,000 lb. would be in firebrick, and the remainder—48,000 lb., in the steel shell and fittings. This would give a weight of 125 lb. per h.p., or a total of 625 short tons, and show a saving of about 375 short tons.

For the operation of the plant there will be required no skilled firemen, and a smaller number of engineers, and the probability of serious accidents will have been lessened.

In a system for which the writer has secured patents, the scrubber heretofore attached to each producer has been omitted, only one central cleaning plant being installed and no gasholder used, even in the case of a pressure producer, thus making the installation one particulary well suited for use on board ship.

Every naval officer will readily appreciate the great advantage to be obtained by avoiding the use of smoke-pipes, and thus reducing the chances of the vessel being discovered at great distances by the clouds of smoke, as at present.

For vessels of the navy the space and weight saved may be utilised for an increase in the armour and armament, or for additional coal supply. With the same coal capacity as heretofore, the saving of about one-third in the coal consumption will give a much greater steaming radius.

There will be no competition between this type of installation and one using a liquid fuel, as the latter is, in the writer's opinion, too expensive as well as dangerous for use on shipboard.

From a paper read before the American Society of Naval Engineers.

OBITUARY.

THE death is announced of Mr. William Bruce Dick, founder of the firm of Dick, Kerr, and Co., Ltd.

The late Mr. John Kyle was associated during a very active life with many important engineering projects. The Waverley Bridge and the Waverley passenger station of the North British Railway Company, Edinburgh; the Glasgow new gasworks at Dawsholm and Dalmarnock; the Ottawa Bridge, Canada; and several other undertakings, were carried out under his supervision. In 1873 he went to Ceylon as resident engineer in connection with the harbour works at Colombo, and on his return to England was associated with dock work on the Manchester Ship Canal, and more latterly with the breakwater and harbour improvements at Dover. He contributed several important papers to the Institute of Civil Engineers, of which he was an old member, and had received the Telford premium.

We regret to announce the death of Mr. William Jessop, chairman of William Jessop and Sons, Ltd., of Sheffield. His decease at the early age of 49 is to be deeply deplored, for he was the head of the great business which bears his name, and the foundation of which dates back to 1774. Although he took little part in the public life of the town with which his family had been so long associated, Mr. Jessop was greatly esteemed for many excellent qualities. The firm of William Jessop and Sons has won a world-wide reputation, and it was only quite recently that they established the Jessop Steel Company in the United States. On succeeding to the chairmanship of his company on the death of his father in 1887, Mr. Jessop devoted himself almost entirely to the duties of that office, retiring from other directorships and retaining only among outside appointments that of president of the Jessop Hospital for Women, founded by his father, and trustee of the Sheffield Royal Infirmary.

Mr. William Stobart, who has just died at the advanced age of 84, was a well-known Durham colliery-owner, and the son of Mr. William Stobart, who will be remembered as a large colliery-owner in the Chester-le-Street district. The deceased was chairman and managing director of the Wearmouth Colliery Co., a director of the Consett Iron Company, and was also considerably interested in the North-Eastern Marine Engineering Works. Having been elected to the Wear Commission in 1850, Mr. Stobart was at the time of his death the oldest member of that body. It may be of interest to state that one of Mr. Stobart's two daughters married the son of the late Professor Huxley.

A NEW CARBON FILAMENT.

By John W. Howell.

THE following data has reference to a new carbon filament, which has characteristics so differing from those of any previously known filament as to seem to indicate that it is a new form of carbon. Besides being very interesting on account of its physical characteristics, this filament is of considerable value on account of its much better life or efficiency as compared with the carbon filaments heretofore known. This new filament is the result of work done in the Research Laboratory of the General Electric Company and in the laboratory of the Lamp Works, at Harrison, N.J.

In briefest outline, the new characteristics of the filament may be said to be done to the proper application of excessively high temperatures to the ordinary carbon filament. The value of the product is determined by the conditions under which the high temperatures are applied.

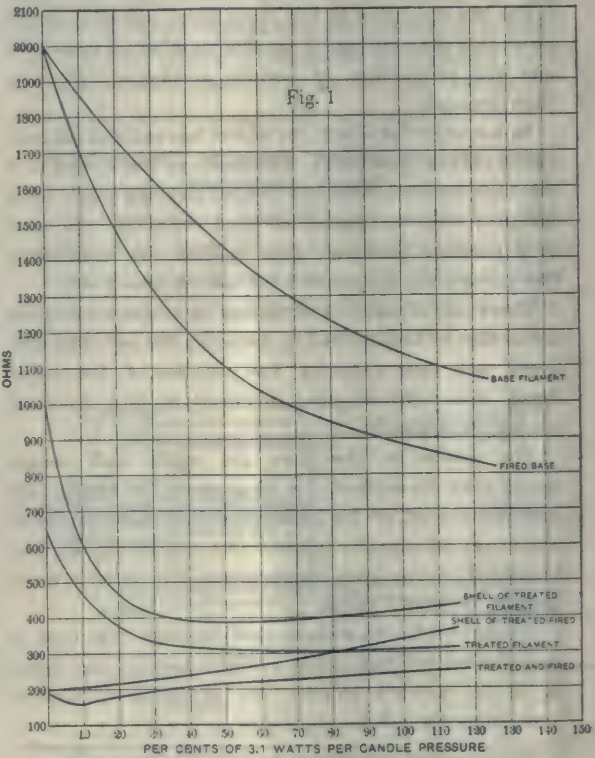
It is well known that an ordinary incandescent filament in an evacuated lamp may be heated to excessive temperatures by the application of high current without producing any beneficial change in the filament. To produce the effects described in this paper the heat is externally applied to treated filaments at atmospheric pressures. The simple application of the highest attainable temperatures to the plain carbonised cellulose fibre, *i.e.*, the so called "filament base," is also incapable of producing any considerable change in the filament. This high temperature treatment of the base is, however, a beneficial step in the process here described.

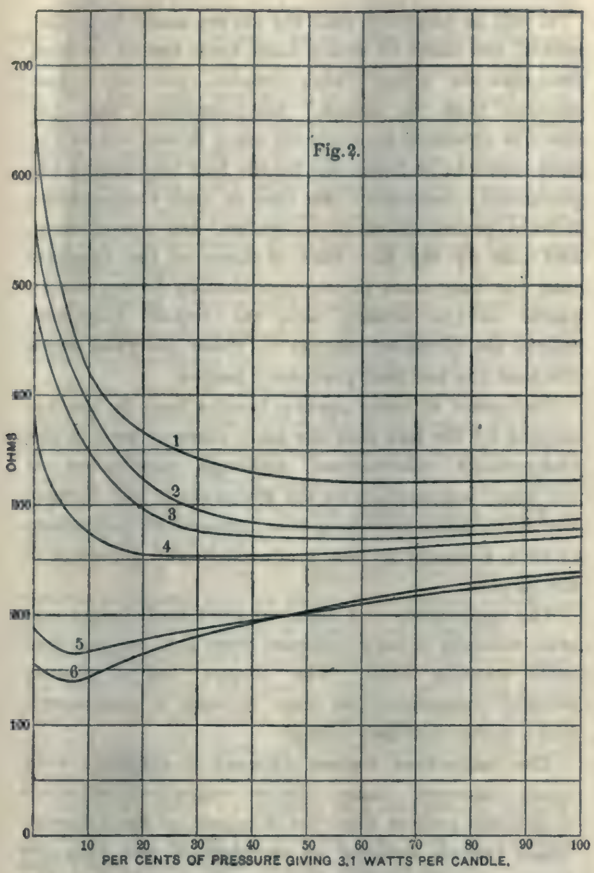
Before describing the new process, it may be well to recall the steps by which the standard filaments are made. A solution of cellulose is squirted through a die into a liquid that hardens the cellulose. The resulting fibre is dried, then shaped into the desired form for the finishing filament and heated in a muffle until carbonised. In this process the highest temperature of a gas-furnace is employed. The product at this point is called a "base filament." The base filaments are usually separately heated by a current passed through them while they are surrounded by an atmosphere of hydro-carbon vapour, and in this way a coat or shell of graphite is deposited upon them. They are then said to be treated filaments. The best quality of standard carbon incandescent lamps of to-day owe their superiority to the use of treated filaments.

In attempting to graphitise carbon filaments it was discovered that treated filaments undergo very remarkable changes when subjected to the highest possible temperature of an electric resistance furnace. The furnace consisted of a carbon tube, held at the ends by large water-cooled copper clamps; the tube was imbedded in powdered carbon to prevent its combustion. The filaments were packed in small, cylindrical carbon boxes, which were fed into the heated tube. The temperature was usually between 3,000 and 3,700 deg. C.

Under such firing the ordinary treated filament changes in appearance; its graphite coating looks as though it had been melted, and its specific resistance is greatly reduced. The resistance of one of these filaments, measured at ordinary temperature, may be reduced as much as 80 per cent. by the firing.

The curves representing the resistance at different temperatures are also remarkable. Fig. 1 shows curves





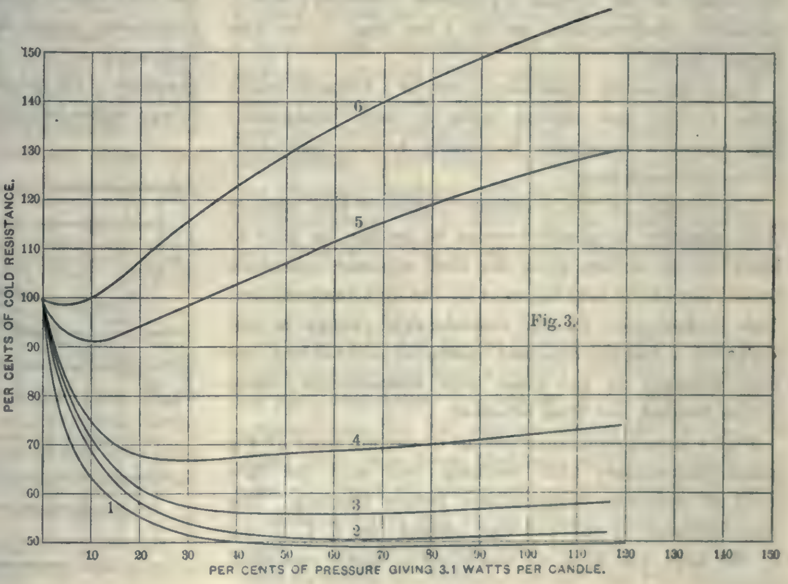
of resistance and temperature of a regular base filament, a base filament fired, a regular treated filament, a treated filament fired, a shell of regular treated filament, and a fired shell. The resistance in ohms is plotted against the temperature, as indicated by the percentage relation of the pressure on the filament to the normal pressure at which the filament has an efficiency of 3·1 watts per candle.

The curves show a more rapid fall in resistance of the base filament after firing, but little change in the character of the curve. The change produced in the treated shell by firing is very great, the cold resistance being reduced 1,000 to 200 ohms, while the great change in the character of the curve of the fired shell brings the hot resistance of the two shells nearly together. The resistance curve of a fire-treated filament depends upon the relative thicknesses of base and coating and upon the temperature of firing. Figs. 2 and 3 show curves of filaments fired at five different temperatures and of a similar filament that has not been fired. In fig. 3 the resistances are shown in percentages of the cold resistances, and in fig. 2 the actual resistances are shown.

These filaments were heated in the carbon tube resistance furnace. They were enclosed in a cylindrical carbon box, placed inside the tube, one end of which was left open for observation. An indication of the temperature was obtained by looking directly into the open end of the tube at the box holding the filaments, and holding in the line of vision the filament of an ordinary 50-volt lamp, the temperature of which was adjusted until the filament became invisible against the incandescent carbon box. The pressure on the lamp was then observed and the box of filaments taken out.

Curve No. 1 is the resistance curve of a regular treated filament. Curve No. 2 is the curve of a similar filament heated in the tube to a temperature corresponding to the temperature of a carbon filament operating at 153 per cent. of its normal pressure, or at 125 candles for a normally 16-c.p. lamp.

Curve No. 3 is the curve of a filament fired at a temperature corresponding to the temperature of a lamp at 161 per cent. of its normal pressure, or at 163 candles. Curve No. 4, 183 per cent. of normal pressure, or at 230 candles. Curve No. 3, 201 per cent. of normal pressure, or at 260 candles, for a 16-c.p. lamp. Curve



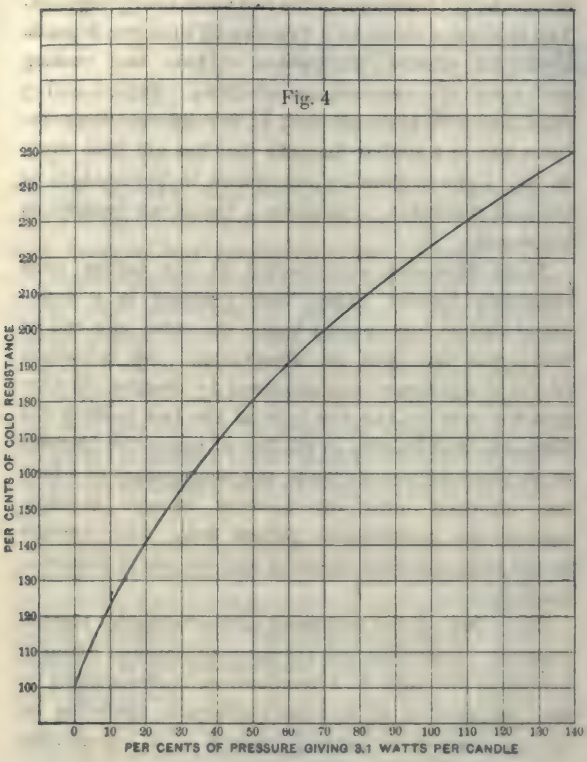


Fig. 4

No. 6 is the curve of a filament heated hotter than No. 5. The temperature was not measured by this method for fear of breaking the comparison lamp.

An attempt was made to measure the temperatures by means of an optical pyrometer (Wanner) which indicated temperatures up to 3,700 deg. C. at the highest heats.

Fig. 4 shows the resistance curve of a filament made from a thin base having quite a thick treatment; this shows a resistance increasing to 250 per cent. of its cold resistance.

The change in the resistance curve of this coating from negative to positive seems to be due, in part at least, to the action upon the shell of some substance driven out of the base filament by the high temperature. This is indicated by the considerable change in the curve of a treated filament produced by heating the base filament to the same high temperature before it was treated and then reheated.

Fig. 5 shows resistance curves of carbon fired at the same temperature after treating, but with the base fired at different temperatures before treating. The base filament in curve *A* was unfired; in *B*, *C*, *D* and *E* the base was fired at successively higher temperatures.

It will be observed that the curves made from filaments, the bases of which have been heated to high temperatures before being treated, are much less positive than the others. The conclusion that the effect is produced by material being driven out of the base seems to be borne out by the fact that during the preliminary heating of the base at high temperatures it loses practically all of its mineral ash constituents, and also by the fact that, if some of the elements that the base loses in its high heating be separately placed in the furnace with the treated filaments, effects are produced similar to those observed when the base has not been previously heated.

The effect of some agency besides heat is also indicated by the fact that the lamp filament used in the temperature observations, although maintained at the same temperature as the filaments in the furnace and for a sufficiently long time, showed no indications of such a change as was produced in the filaments in the furnace.

The appearance of a filament fired both before and after treating is very different from that of one fired after treating only. The former has a slightly pebbled appearance, as seen through a microscope, and a rather dull-grey colour.

The single-fired treated filament is generally very much blistered, many blisters extending outwards a distance greater than the diameter of the filament. These blisters indicate an overflow of gas from the base when the shell was in a soft condition. The surface of the filaments is highly lustrous.

The specific resistance of the highly heated coating has been found to be as low as 0·00006 ohms per cubic centimetre, which is very much lower than the specific resistance of any other known form of carbon or graphite. Its specific gravity is also much higher than it was before heating

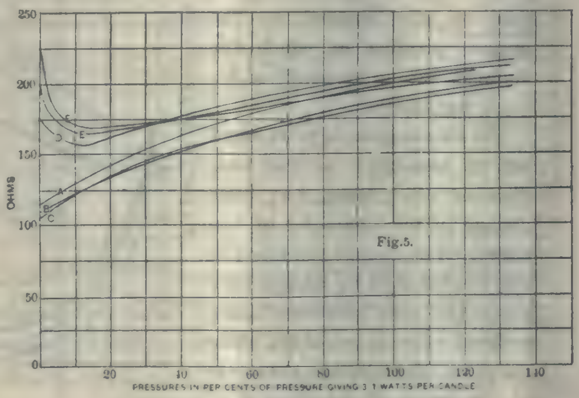


Fig. 5.

Its changed nature is also indicated by its toughness and flexibility. The coating of a double-fired filament may be pulled off in short tubular sections, which if pressed flat, will spring back to their original form when the pressure is removed. The same coating before beginning firing is comparatively brittle, and will break with very little pressure. On account of the positive resistance curve and physical characteristics of these filaments, they have been given the name "metallised filaments."

The treated coating on filaments, even before firing, is graphite, as determined by the chemical test established by Berthelot—the production of graphite acid (a yellow insoluble substance) when treated with a mixture of anhydrous nitric acid and potassium chlorate. Ordinary carbon is dissolved by these reagents. The coating on the treated filament has also the greasy feel of graphite, and gives the characteristic mark of graphite on white paper.

After being heated to high temperatures in the electric resistance furnace these characteristics continue and the chemical action is much more marked.

Metallised filaments blacken the lamp bulb very much less than ordinary filaments. This may be due to the removal from the former of practically all the mineral ash and other impurities, or it may be due to the changed character of the carbon itself.

Bamboo, coated by dipping in a solution of asphalt, is altered by firing, the coating changing to graphite and giving the characteristic positive curve.

Silk dipped in a sugar solution also gives the same result.

The base of a metallised filament, from which the treated coating has been removed, when mounted in a lamp has been found to give the resistance curve of a fired base. Pieces of the coating, about 1·5 in. long, mounted in lamps, have been found to give the strongly positive resistance curve that is characteristic of the metallised filament. These observations show that the change is practically all in the treated coating and not in the base.

Metallised filaments, as above described, are much more stable at high temperatures than ordinary carbon filaments.

The most effective carbon filament lamp now in general use operates at 3·1 watts per candle and under accurate test conditions gives a useful life (to 80 per cent. of its initial candle power) of about 500 hours. At the present time metallised filaments that give the same useful life at about 2·5 watts per candle are being produced with a fair degree of uniformity.

Presented at the Twenty-second Annual Convention of the American Institute of Electrical Engineers, Asheville, N.C.

ENGINEERING IN JAPAN.

A CONSULAR report on the trade of Kobe and Osaka states that the volume of the metal trade has shown a decided increase, and on the whole the market has been a favourable one to most importers; the general feeling is that the war has had a good deal to do with this. It is considered that the naval and military successes will tend in time to the advantage of business, and that 1905 will be a prosperous year. The Government foundry in Kiushiu has not apparently interfered to any extent with the trade, having all it can do at present to attend to Government requirements. The imports of machinery show a large increase over those for 1903. This was due principally to the war, which has necessitated heavy purchases by the Government, and also to the increasing demand for labour-saving machines in Japanese dockyards, factories and other works. The United States have done particularly well in this line.

The port of Kobe boasts of a shipbuilding yard which is prepared, so it is stated, to compete with any firm in the East or West in the matter of shipbuilding. Its plant is described as complete and up to date. The company—the Kawasaki Dockyard Company—is not a new institution, but has recently completed its equipment. Electricity is the motive power of the plant. The Kawasaki Dockyard Company at present has the monopoly in the shipbuilding industry at Kobe, but it will shortly have a rival establishment under the auspices of the Mitsu Bishi Company, already known for its shipbuilding plant at Nagasaki. This company has commenced work on a breakwater and on a floating dock capable of accommodating ships of 7,000 tons. They expect to be able to dock ships by the middle of next year. At Osaka, a private shipbuilding yard, which, though Japanese owned, was originally founded with British capital, turns out excellent work. It is known as the Osaka Ironworks and Dockyard. There are 2,500 workmen employed.

* * *

According to Nature, the Barnard Medal of Columbia University has just been awarded to Prof. H. Becquerel for his "important discoveries in the field of radio-activity, and for his original discovery of the so-called dark rays from uranium, which discovery has been the basis of subsequent research into the laws of radio-activity, and of our present knowledge of the same." The medal has been previously awarded to Lord Rayleigh, Sir William Ramsay, and Prof. Röntgen.

TRIALS OF GAS ENGINES WORKED FROM SUCTION GAS-PRODUCERS AT THE GLASGOW AGRICULTURAL SHOW.

Details from the preliminary report referred to on the opposite page are appended. It will be remembered that the object of the trials was to demonstrate the value of the combination of the "suction" gas-producer and gas engine as a cheap source of power.

PLANTS WHICH COMPLETED THE TRIALS WITHOUT A STOP OF ANY DESCRIPTION.

	Catalogue Reference.	FULL LOAD TRIAL.			HALF LOAD TRIAL.		
		Duration of Trial: Hours.	B.H.P.	Coal per B.H.P. per Hour: Lbs.	Duration of Trial: Hours.	B.H.P.	Coal per B.H.P. per hour: Lbs.
The National Gas Engine Co., - -	D *(a)*	10	9·74	0·84	10	5·36	0·91
The Campbell Gas Engine Co., - -	A *(a)*	10	20·44	0·93	10	10·69	0·92
Tangyes Limited, - - - -	C *(a)*	10	19·98	0·83	10	10·72	1·08

PLANTS WHICH HAD ENGINE AND PRODUCER DEFECTS.

	Catalogue Reference.	FULL LOAD TRIAL.			HALF LOAD TRIAL.			REMARKS.
		Duration of Trial: Hours.	B.H.P.	Coal per B.H.P. per Hour: Lbs.	Duration of Trial: Hours.	B.H.P.	Coal per B.H.P. per Hour: Lbs.	
The National Gas Engine Co., -	D (*b*)	10	20·57	0·80	10	10·48	0·95	8 mins. stop during half load trial due to carbon deposits on igniting points.
The Campbell Gas Engine Co., -	A (*b*)	10	8·25	1·22	10	4·43	0·94	Load on brake relieved for 2 mins.; and engine stopped for a few seconds to replace a pin on ignition gear.
Tangyes Limited, - - - -	C (*b*)	10	8·34	1·25	10	4·57	1·48	Load off for 9½ mins. on full load trial due to poor gas; engine did not stop.
Crossley Brothers, Ltd., - -	E	8·12	15·35	0·77	10	9·06	0·96	Stopped during full load trial owing to shortage of water in producer. Load on brake relieved during half load trial—premature ignition.
Industrial Engineering Co., - -	B (*b*)	10	9·72	1·13	8·43	4·36	1·55	Stopped on half load trial owing to defect in producer.

THE ACME ENGINE Co. (F).—The Engine was not ready to start at commencement of Trial and was not subjected to any complete tests.

THE INDUSTRIAL ENGINEERING Co., B *(a)*.—During Full Load Trial the Engine was compelled to stop owing to heated bearing, and on the Half Load Trial there were several stops causing the results to be so unreliable as to render the trial of no value.

In arriving at the above results as to coal consumption, due allowance has been made for ash and clinker.

TRIALS OF GAS ENGINES WORKED FROM SUCTION GAS-PRODUCERS AT THE GLASGOW AGRICULTURAL SHOW.

A PRELIMINARY report has been issued on the above trials with a view to placing in the hands of the exhibitors and others interested a few general particulars as to some of the chief results obtained. It is not intended to be taken as representing in any way the final finding of the committee; a further and complete report will be published later. In order to obtain reasonably correct results as to fuel consumption, every possible precaution was taken to bring the fuel etc., in each producer at the end of a trial into the same condition as at the beginning; in this respect considerable difficulty was met as the design of most of the producers is such as to render it almost impossible to gauge accurately the state of the fire as to ash and clinker. There is no difficulty in removing the ash, etc., from the immediate vicinity of the firedoor, but in the majority of the producers it is impossible to extract the ash, etc., from the back of the fire without bringing down most if not all the fuel in the producer

DURATION OF TRIALS.

By making the duration of each power trial ten hours it is considered that any error in arriving at an estimate of the fuel consumption will be minimised; at the same time, in view of the extraordinarily small amount of coal used in some of the plants, it is necessary to draw attention to the fact that the figures given herewith may be slightly under the true value, though the degree of error cannot be large.

Each plant was required to undergo a full and half power trial of not less than ten hours, also a light load trial for a period of five hours. In the light load trial the coal consumption was not measured, as the object was rather to ascertain the capabilities of the producers to supply gas to the engines when running without any load. All the plants completed this light load trial satisfactorily.

A further test was made to ascertain the time required to get a plant up to full working load, starting with producer empty and cold.

EXAMINATION FOR CLINKERING.

At the end of the first three days' trials the producers were emptied and examination made for clinkering. Very little clinker was found in any of the producers, there was most in the Dowson producers—used by the National Gas Engine Company. This may be accounted for by the fact that practically no provision is made in this producer for clearing out the ash and clinker while in operation.

Scotch anthracite "peas," from Gartshore Colliery and supplied by Mr. James Cunninghame, 12, Waterloo Street, Glasgow, were used throughout the trials The indicators were supplied by Messrs. Dobbie, M'Innes, Ltd., Glasgow.

Particulars of Gas Engines and Producers are included in the annexed tables:—

EXHIBITOR.	CATALOGUE REFERENCE.	ENGINE.				PRODUCER
		B.H.P. Declared.	Diameter of Cylinder. Inches.	Stroke Inches.	Revs. per Minute.	Capacity. Cubic Feet.
The Campbell Gas Engine Co. ..	A(*a*)	18	9½	18	200	4.18
	(*b*)	8	7	12	230	2.26
The Industrial Engineering Co. ..	B(*a*)	22	10	17	220	4.08
	(*b*)	13½	8½	14	230	2.17
Tangyes, Ltd. ..	C(*a*)	19	10	19	190	2.36
	(*b*)	7½	7	16	220	1.59
National Gas Engine Co... ..	D(*a*)	8	7	15	220	2.98
	(*b*)	20	10	18	190	5.89
Crossley Bros. ..	E	18	8½	20	200	4.31
Acme Engine Co.	F	22	10	17	220	Not taken

The time taken to get up each plant to full working load was as follows: The Campbell Gas Engine Company, A (*a*) 13 min.; (*b*) 17½ min. Tangyes Ltd., C (*a*) 16 min.; (*b*), 12½ min. The National Gas Engine Company, D (*a*) 15¾ min.; (*b*) 48 min. Crossley Brothers, E, 15½ min. The Acme Engine Company, F, did not start. The Industrial Engineering Company, B (*a*) failed to start through water passing into cylinder from producer; (*b*) started, but was compelled to stop through water being shut off at main.

MOTOR NOTES.

THE GORDON-BENNETT RACE AND AFTER.

NOW that Théry has scored another win for France in the big Motor Derby, and the excitement has somewhat abated, the makers of motors are confronted with the inevitable *qui bono* ? Select a course like that of the Auvergne Circuit, with as many startling zig-zags as possible, and pit one against another a series of machines that are useless for the ordinary purposes of locomotion, heighten the sporting element by demanding the utmost endurance from man and machine and you get a very good race, but the development of the automobile is an altogether different matter. There are so many directions which offer scope for improvement in construction for practical purposes that the Gordon-Bennett race may come to be looked upon by manufacturers ere long as a species of misdirected energy.

Mr. Henry Sturmey, in the Autocar, boldly asks the question—Is racing played out ? and he does not hesitate to answer the question with an emphatic affirmative. He goes on to assert that the eliminating trials of the Gordon-Bennett race have taught us practically nothing except the way in which the cars of the best known reputation, and admittedly the best the firms who make them can produce, fail in important particulars. No one can say that the trials were a striking demonstration of the reliability of the motor-car of to-day, and no one would say that either of the machines used would make a touring car, although, of course, they will travel over the roads, and one might "tour"—or get about from place to place—upon them, if one liked to call it touring.

NEW CONDITIONS DESIRABLE.

The value of the advertisement to the successful firms is undoubted, but what of the rest ? There appears to be a growing feeling that the concentration upon racing cars is not worth the disorganisation and delay which it is liable to cause in ordinary business,

Nationality.	Makers.	Drivers.	Engine.					Cooling and Radiator.	Clutch.	Weight complete.
			No. of Cylinders.	Bore.	Stroke.	Power.	Ignition.			
				mm.	mm.					
France..	Richard-Brasier	Théry ..	4 vert., in pairs	160	140	96h.p.	Magneto	Centrifugal pump tubular radiator	Leather cones	994 kilo.
,,	,,	Caillois ..	,,	160	140	96 ,,	,,	,,	,,	1,000 ,,
,,	De Dietrich ..	Duray ..	,,	190	150	130 ,,	,,	,,	,,	1,003 ,,
England	Napier ..	Earp ..	6 vert., separ'te	158	127	90 ,,	Accu'l'rs.	Pump : tubes	Metal to metal	996
,,	Wolseley ..	Rolls ..	4 horzl., separ'te	181	152	112 ,,	,,	Pump : tubular radiator	Leather cones	998 ,,
,,	,, ..	Bianchi ..	,,	181	152	112 ,,	,,	,,	,,	995
Germany	Mercedes ..	Jenatzy ..	4 vert., in pairs	185	150	125 ,,	Magneto	Pump : honeycomb radiator	Metallic	1,006 ,,
,,	,, ..	De Caters ..	,,	185	150	125 ,,	,,	,,	,,	1,005 ,,
,,	,, ..	Werner ..	,,	185	150	125 ,,	,,	,,	,,	1,003 ,,
Italy ..	F.I.A.T. ..	Lancia ..	,,	185	150	110 ,,	,,	,,	Multiple plates	1,007 ,,
,, ..	,, ..	Cagno ..	,,	185	150	110 ,,	,,	,,	,,	1,006 ,,
,, ..	,, ..	Nazzari ..	,,	185	150	110 ,,	,,	,,	,,	1,005 ,,
Austria	Mercedes ..	Braun ..	,,	185	150	125 ,,	,,	,,	Metal to metal	1,001
,,	,, ..	Hyeronymus	,,	185	150	125 ,,	,,	,,	,,	1,005 ,,
,,	,, ..	Burton ..	,,	185	150	125 ,,	,,	,,	,,	1, 05 ,,
America	Pope-Toledo ..	Lyttle ..	4 vert., separ'te	140	140	70 ,,	Accu'l'rs	Pump : tubular radiator	Leather cones	992 ,,
,,	,, ..	Dingley ..	,,	140	140	70 ,,	,,	,,	,,	984 ,,
,,	Locomobile ..	Tracy ..	4 vert., in pairs	170	150	100 ,,	Magneto	Pump : honeycomb radiator	Metal to metal	1,007 ,,

TECHNICAL DETAILS OF COMPETING CARS IN THE GORDON-BENNETT RACE.

and it is urged in some quarters that if racing is to continue it should be modified by rules framed with a view to enhancing the practical utility of the cars.

In the Motor, Mr. S. F. Edge gives it as his opinion that racing with very high-powered cars will die out, and that small racing cars will come in, which will have to be limited in weight, and by their petrol consumption; in other words, cars which will be on the same lines as the Tourist Trophy car, but perhaps a little more powerful, as it is to this class of car that we look to preserve the future of motor racing.

Mr. C. Jarrott, in the same paper, makes a practical suggestion. He says: I cannot say that automobile racing at the present time is of very much value, because the rules under which it is carried out necessitate the building of vehicles which in themselves assist very little in the construction of the commercial touring vehicle, but if rules were framed limiting cylinder capacity and stipulating for a proper weight of chassis, comparative tests between the makers, *i.e.*, racing, would be of the utmost value in securing the evolution of a very efficient touring vehicle, perfecting motor construction, and the elimination of friction in the running gear. Some of the leading details of the competing cars in the Gordon-Bennett race are given on the preceding page.

TRIALS AT LINCOLN.

Lincoln provides some exacting hills for testing the capabilities of motors in climbing, and last week Messrs. Rose Bros., of Gainsborough, used the steepest inclines in the city for the purpose of testing one of their new cars. The car was one with the firm's ordinary standard chassis, the three-cylinder engine being of about 18 h.p. It was driven by Mr. L. T. R. Radley. The best test was the climbing of Steep Hill, which has an average gradient of 1 in 6·4. Four passengers were first carried, the car proceeding up the High Street and through the Strait on to the Hill; thence round Well Lane and Danesgate to the Mayor's Chair, and thence on again past Christ's Hospital Terrace and up Wordsworth Street. This test was again accomplished with perfect ease, and without any faltering on the second speed.

MOTOR PROGRESS IN GERMANY.

Motor-cars are rapidly becoming more popular in Germany. A consular report just issued cites the fact that at the end of 1904 there were 1,158 motor-cars in Berlin, compared with only 582 a year ago. Manufacturers were well employed, but the higher prices for raw materials, metals, and pneumatic tyres reduced profits. There is a great demand for motor boats, motor cycles, and motor tricycles for business purposes.

THE PRICE OF LEAD.

Not since 1901 has the price of lead been so high as of late, with the exception of the scare caused about two years ago when the chief Australian mines were shut down through the stoppage of water supply Last week the price of foreign lead rose to £13 10s. per ton, or within 5s. of the extreme limit reached during the scare referred to. Some months ago the market fell to about £11 17s. 6d., but the recent sharp rise is due to the fact that the arrivals here have for weeks past continued abnormally small in view of the persistent diversion of supplies from Spain direct to Germany and Russia, while parcels from Australia arriving here were also transhipped to the former country. There is nothing to show that production has been in any way curtailed in the chief exporting countries, yet the present scarcity has become so accentuated as to make consumers, ill-provided for near requirements, feel rather uncomfortable, while dealers who made blank sales a short time ago in anticipation of larger imports have mostly repurchased at a loss. Last week numerous inquiries were in the market, but holders were not easy to deal with, as the quantity of metal left in warehouse is very limited. It is possible that abnormally large quantities may continue to be absorbed for some time longer by Germany, chiefly for electrical purposes, and while Japanese needs may also have to be satisfied from Australia direct in the near future, there is but little prospect, writes a daily contemporary, of the price being for the present lowered to a normal level.

DOINGS IN THE FLEET.

Our readers will remember the son of Neptune who recorded the benefits of a certain cocoa while engaged in the alleged "soldering" on of a broken propeller. We quote the following from The Fleet:—

"I saw you first!" shouted C. S. Cables, Mechanical O.D., as he saw the lost propeller-blade come floating by.

"Just wait until I get some solder, and I'll come down and stick you on again."

"Right, O!" shouted the propeller-blade, as he dived down. "I'll go down and get ready for you—but mind, don't forget to bring the cocoa."

The Fleet, by the way is a lively and well-written illustrated paper concerned with the doings of the navy. Admiral Sir John Fisher has just expressed the hope that it may have the success it deserves—a wish which we heartily second.

AMERICAN NOTES.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

JUDGING by the long list of papers and the animated discussions which followed some of them, the twenty-second annual convention of the American Institute of Electrical Engineers appears to have been a very successful meeting. The opening address by the President, Mr. John S. Lieb, of New York, was an analytical study of the national engineering societies, embodying various suggestions for the development of the American Institute of Electrical Engineers. The following tables were included, showing the membership in the several classes, according to the last official reports and details of cost. As a matter of general interest, the President also added the subjoined tabulation of the more important European engineering societies :—

NATIONAL ENGINEERING SOCIETIES (U S)

Name and Date of Organization	Date of Report	Hon Members	Full Members	Asso Members	Associates	Junior Members	Total
American Society of Civil Engineers, 1852. .	Jan 1, 1905	9	1795	903	127	*367	3203
American Institute of Mining Engineers, 1871	Jan. 1, 1905	7	3483	—	190	—	3680
American Society of Mechanical Engineers, 1880.	Jan. 1, 1905	19	1915		237	609	2780
American Institute of Electrical Engineers, 1884	Jan. 1, 1905	2	481	2851	—	—	3334

* Including 27 Fellows

	Entrance Fees			Annual Dues			Foreign	
	Juniors.	Associates	Members.	Juniors	Associates.	Members	Associates	Members
Amer. Society Civil Engineers.......	$10	$20-25	$30	$10-15	$10-15	$15-25		
Amer Institute Mining Engineers....	—	10	10	—	10	10		
Amer Society Mechanical Engineers.	15	25	25	10	15	15		
Amer. Institute Electrical Engineers..	—	5	15	—	10	15	5	10

EUROPEAN SOCIETIES.

Name and Date of Organization	Date of Report	Hon Members	Full Members	Asso Members	Associates	Total
Institution of Civil Engineers (of Great Britain) 1818....................	Jan. 1. 1905	19	2191	4116	271	*6597
Institution of Mechanical Engineers 1847	Mar. 1. 1905	9	2351	1545	72	†3977
Iron and Steel Inst., 1869....... ..	Jan. 1, 1905	11	1898	—	—	1909
†Institution of Electrical Engineers 1889	Aug 31, 1904	6	*1101	1435	1761	‡4303
Verein Deutscher Ingenieure. 1891....	Apr. 24. 1903	6	17543	—	—	17549
Societé des Ingénieurs Civil de France. 1848	1901	—	—	—	—	3691

* Includes 136 Foreign Members
* Not including 1144 Students or Graduates
† Originally organized as the Society of Telegraph Engineers and Electricians in 1871
† Not including 450 Students or Graduates.
‡ Not including 1107 Students or Graduates

In suggesting an increase in the fees of the Electrical Institute the President remarked that having regard to the new relations entered into between the three national engineering societies, which are to occupy jointly the Union Engineering Building, and as the societies have now roughly about the same membership, it would appear to be desirable to have membership dues as nearly on a uniform basis as practicable.

LEWIS AND CLARK CENTENNIAL EXPOSITION.

This Exposition, which has been opened at Portland, Or., takes its name from two hardy explorers, Captains Meriwether Lewis and William Clark, who, with a little band of followers, pierced the wilderness a hundred years ago and discovered an overland route to the Pacific Ocean, thereby adding, by right of discovery and exploration, a territory of 307,000 square miles to the holdings of the United States on the American continent. The event certainly is worthy of suitable commemoration by a centennial exposition, and the Fair is worthy of the event. While smaller than the expositions held at Chicago and St. Louis, that at Portland is by great odds the biggest thing ever attempted in the Pacific West. Its world's aspect is secured by the participation of many foreign countries, while State participation is extensive, and the United States Government has a display and buildings which represent an expenditure of $800,000. The Fair has cost $5,000,000 so far, and its exhibit palaces contain displays worth five times as much.

Departing from the precedent set at St. Louis, the Portland Exposition has no separate power station on the grounds, but has made an arrangement with the Portland General Electric Company; and for the purpose of supplying power for the Fair, the company has included in its plant two 1,500-kilowatt turbines.

In the illumination of the Fair, about 100,000 8-candle-power frosted lamps are used in outlining the buildings. There are also 5,000 50-candle-power Meridian lamps used in electroliers on the "Bridge of Nations," which connects the Government Peninsula and the mainland, the "Lake Shore Esplanade," which follows the shore of Guild's Lake for nearly a mile, and the drive-ways and avenues throughout the grounds. The service is supplied through 2,200-volt feeders, and is distributed to various transformer pits located just outside the buildings. The secondary wire distribution is 117 volts.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contract.

CONTRACTS OPEN.

	Last Day.
Earby, Skipton.—Construction of sewage tanks, bacterial filters, storm-water filter, engine-house, and other works for the extension of the Earby sewage disposal works, for the Skipton Rural District Council. Mr. H. A. Johnson, M.I.C.E., 15, Exchange, Bradford	July 14
Neath.—Supply, laying, fixing, and connecting electric light and power mains, substations, switch-boards, feeding pillars, switch pillars, excavations, and other works in connection therewith within their area, for the Neath Rural District Council. Mr. H. T. Sully, consulting engineer, Scottish Widows' Buildings, Bristol	July 17
Londonderry.—Supply and delivery of two traction engines, two road sleeping-vans, two stone-breaking machines, for the County Council. County Surveyor, County Court House, Londonderry ...	July 18
Loughborough.—Supply of the following materials and stores for the year ending July 31st, 1906, for the Gas and Electricity Committee: (1) oils; (2) engine-room stores; (3) cables; (4) cable fittings and accessories; (5) meters; (6) D.P. switches and fuses; (7) 3-b.h.p. and upwards 440-volt direct-current motors and starters; (8) ½-b.h.p. to 3 b.h.p. 220-volt direct-current motors and starters; (9) ironmongery and sundries; (10) house-service fuses; (11) turbine generator brushes. Schedules and forms of tender may be obtained on application to Mr. Walter H. Allen, borough electrical engineer, Electricity Works, Bridge Street, Loughborough	July 18
London.—For works to be executed in connection with the partial reconstruction of four bridges carrying the Albert Embankment road over dock entrances in the borough of Lambeth; and of Mill Pond Bridge, in Nine Elms Lane, in the borough of Battersea, for the London County Council. The chief engineer, Mr. Maurice Fitzmaurice, C.M.G., County Hall, Spring Gardens, S.W.	July 18
Shoreditch.—Extension of plant at Whiston-street generating station, including two 1,500-kw. steam turbo-generators, condensers, pumps, piping, etc. Dr. H. M. Robinson, Town Hall, Old Street, E.C.	July 18
Caerphilly.—Urban District Council invite tenders for supply, delivery, laying and erection of high and low-pressure underground cables, kiosks, transformers, switch gear, lamp pillars, etc.	July 24
Esk.—For the works to be executed in the construction of the steelwork required in the renewal of the superstructures of the 11 remaining spans of Esk Viaduct at 6 miles 50 chains on main line north of Carlisle, for the Caledonian Railway Co. Drawings may be seen at the office of the Company's District Engineer, Princes Street Station, Edinburgh.	July 24
Dublin.—Supply of three electric locomotives for haulage of refuse wagons on the city tramways; nearly 1,000 yards run of street tram tracks and electricity mains, overhead trolley wires, with street posts and connections; two electric and one steam capstan, etc., for the Cleaning Committee. City Engineer, Mr. Spencer Harty, City Hall, Dublin	July 25
Malvern.—Construction of the rising main from Bromsberrow to the British Camp reservoir, and other contigent works for the Malvern Urban District Council. The work will be divided into two contracts, viz.: (Contract No. 3) 6.553 yards or thereabouts of 10-in. cast-iron pipe mains, complete; 4) 3,500 yards or thereabouts of 10-in. cast-iron pipe mains, complete. Also construction and erection of pumping machinery, including deep-well pumps, Lancashire boilers, and contingent works at their new pumping station, Bromsberrow Heath. Mr. William Osborne Thorpe, surveyor and water-works engineer.	July 26
Glasgow.—Supplying two twin-screw steam hopper barges of 1,200 tons capacity each, for the Trustees of the Clyde Navigation. Mr. Geo H. Baxter, mechanical engineer, 16, Robinson Street, Glasgow	—
Ebbw Vale (Mon.).—For the Ebbw Vale Urban District Council, four sections—(Section A) cables; (B) overhead lines); (C) street lamps and fittings; (D) meters. Mr. Reginald P. Wilson, 66, Victoria Street, Westminster...	Aug. 5
Merthyr Tydfil.—Erection of refuse destructor plant capable of effectually burning 120 tons of refuse per day, together with all buildings and contingent works connected therewith, for the Merthyr Tydfil Urban District Council. Mr. T. Fletcher Harvey, engineer and surveyor to the Council, Town Hall, Merthyr Tydfil	Sept. 1

COMING CONTRACTS.

Dorking.—An inquiry has been held into an application for sanction to borrow £12,000 for electric light works.

Shewsbury.—Two water supply schemes are under consideration, one to cost £148,000, and the other £88,000.

West Hartlepool.—A sum of about £4,000 is to be expended in electricity extensions.

Frome.—The Council have decided to borrow £11,000 for installing electrical supply works.

Ladybank.—A new sewage scheme, estimated at close on £5,000, has been adopted.

Barry.—The Council have under consideration a scheme to provide the town with a system of electric tramways.

Wick.—A loan of £70,000 and a grant of £20,000 have been sanctioned in connection with the harbour extension.

Marple.—The Council are asking sanction to spend £3,000 on gaswork extensions.

Yarmouth.—An inquiry has been held into an application of the Council for sanction to a loan of £10,000 for electricity extensions.

CONTRACTS CLOSED.

Pontypridd.—Joseph Wright and Co., have received an order from the Albion Steam Coal Company, of Pontypridd, for two of their patent improved King's safety detaching hooks. These hooks will be fitted with special tackle, and will be constructed for a safe working load of 25 tons, and will have a breaking strain of 250 tons.

London.—In connection with the enlargement of Victoria Station, Messrs. Andrew Handyside and Company, Britannia Ironworks, Derby, and Messrs. Head, Wrightson, and Company, Teesdale Works, Thornaby-on-Tees, are supplying the ironwork; Messrs. Galloways, Ltd., Manchester, boilers; the Phœnix Art Metal Engineering Company, London, new gates; and Messrs. Cowans, Sheldon and Company, Carlisle, a 60-ft. turntable.

Great Western Railway.—Messrs. Kerr, Stuart and Co., Ltd., of London and Stoke-on-Trent, have received an order from the Great Western Railway for fourteen steam motor-saloons. This is the largest order of the kind yet given out. Each of the saloons just ordered is a complete train in itself, the locomotive and the saloon carriage forming one coach about 70 ft. in length.

Newport (Mon.).—The Alexandra (Newport and South Wales) Docks and Railway Co., have instructed Messrs. W. Simons and Co., Renfrew, to proceed with the construction of a powerful twin-screw bucket hopper dredger of 750 tons capacity for the deepening of the above port.

London.—The Brush Electrical Engineering Company, Ltd., of Loughborough, Leicestershire, have recently secured the following contracts: Four double-deck car bodies mounted on radial trucks, for the Scarborough Tramways (per British Thomson-Houston Company); five motor-coach bodies for the Great Northern and City Railway; thirteen trailer-coach bodies, with trucks and air-brake gear (per S. Pearson and Son); and fifty sets of tramcar lifeguards, for the Belfast Corporation.

Sheffield.—Messrs. Davy Brothers, Ltd., Park Ironworks, Sheffield, are supplying a new and up-to-date armour-rolling plant for the Cyclops Works, Sheffild, of Cammell, Laird and Co., Ltd. The rolls are 48 in. in diameter, and 14 ft. in length.

Edinburgh.—Bruce Peebles and Co., Ltd., have secured orders from the Risca Collieries, South Wales, for 1,800 h.p. in pumping and hauling (average size 180 h.p.); from the Darbishires Quarries, North Wales, for 1,500 h.p. in motors, varying in size from 50 to 150 h.p.; and from the Bow Hill Collieries, for 500 h.p. in pumping and hauling plant.

APPOINTMENTS VACANT.

Hull.—A lecturer on electrical engineering is required at Hull Municipal Technical School. Salary £200. Dr. J. T. Riley, Education Offices, Albion-street, Hull ... July 15

West Bromwich.—Borough electrical engineer and manager of the electricity undertaking. Salary £300 per annum. Mr. Alfred Caddick, town clerk ... ... July 17

Cheltenham.—Borough electrical engineer. Salary £400 per annum. Mr. R. Owen Seacome, town clerk ... ... July 18

Belfast.—Library and Technical Instruction Committee invite applications for the position of assistant lecturer in electrical engineering. Salary £160 per annum. Mr. Fras. C. Forth, Director of Technical Instruction ... ... July 19

Newcastle-on-Tyne.—City engineer and town surveyor. Salary £800 per annum, rising to £1,000. Mr. Hill Motum, town clerk, Newcastle ... ... Aug. 5

Leeds.—City engineer. Salary £600 per annum. Particulars of town clerk ... —

APPOINTMENTS FILLED.

Glasgow.—Mr. G. Moncur, B.Sc., A.M.Inst.C.E., has been appointed to the lectureship in Civil Engineering at the Glasgow and West of Scotland Technical College.

Newcastle.—The Council of the Armstrong College of University of Durham in Newcastle has appointed Mr. J. Hall, of Manchester, as demonstrator in mechanical engineering, and Mr. W. W. Firth, M.Sc., as demonstrator in electrical engineering.

Alexandria.—Mr. William Henry Cadman, B.Sc., has been appointed professor of science at the Government College.

New Zealand.—Mr. Albert E. Armstrong has been appointed chief electrical engineer to the Waihi Grand Junction Gold Co., New Zealand. He will supervise the erection and working of the electrical installation at the mine.

Kilkenny.—The appointment of Mr. R. J. Gore as engineer to the Kilkenny Corporation has been confirmed.

Birmingham.—Professor Stephen M. Dixon, M.A., has been elected to the recently-established chair of civil engineering in the University of Birmingham.

Dukinfield.—Mr. Harrison Veevers, the present engineer of the Dukinfield Corporation Gasworks, has been appointed consulting engineer of the undertaking.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that whilst our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—

Consols: Aug. 3rd, Sept. 1st. General Settlements: July 28th, August 16th, 31st. Bank Rate, March 9th, 1905, 2½ per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	1¾— 2¼
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	4¼-- 4¾
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3¼ — 3⅜
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜— 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102—104*
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt. Debs. Red.	100	96 — 99*
530,000	1	2/4⅘	Babcock and Wilcox, Ltd., Ord.	1	8⅜— 8⅝
100,000	1	7⅕d.	Do. ,, 6% Cum. Pref.	1	1½— 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4¾— 5¼
250,000	1	6⅗d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101—103*
150,000	4½	2/8⅖	Barrow Hæmatite Steel Co., Ld., O.	4½	1 3/16 - 1 5/16
50,000	4½	3/-	Do. do. Cum 2nd. Pref.	4½	4⅛— 4⅜
83,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾— 5¼
£500,000	100	4½%	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	102—104*
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	12 — 12½
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	98—100*
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	7/16 — ½
300,000	1	6⅗d.	Do. 5½% Cum Pref.	1	⅝— ¾
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	94 —97*
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	15/16 — 1
1,860,900	1	3⅗d.	Do. Nos. 1,639,101-3,500,000	12/-	½— 9/16
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1 3/16—1 5/16
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1 11/16—1 13/16
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11¼—11½
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord.	5	8⅜— 8⅝
232,500	5	2/6	Do. 5% Cum. Pref.	5	5 3/16— 5 5/16
450,000	1	1/2⅖	Clayton & Shuttleworth, Ltd., Ord.	1	15/16— 1
70,000	5	2/6	Do. 5% Cum. Pref	5	5¼— 5½
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	100 -102*
100,000	10	7/6	Consett Iron Co., Ltd., Ord.	7½	81 - 82
57 031	10	10/-	Crossley, Bros., Ld., Ord. 40340/97370	10	15⅞—16
40,339	10	5%	Do. 5% Cum. Pref.	10	11¾—11⅞
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2⅛— 2⅜
1,259,594	1	3⅗d.	Dorman, Long & Co., Ltd.	1	17/32— 19/32
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	87 —91*
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	2¾— 3¼
250,000	1	9⅗d.	Dunlop (James) & Co., Ltd., Ord.	1	½— ⅝
300,000	1	7⅕d-	Do. 6% Cum. Pref.	1	⅞ -1*
4,721	13	13/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	8½— 9½*
69,754	13	10/-	Do. do. do.	10	6¾— 7¼*
20,250	10	8/-	Elliott's Metal, Ltd.	8	4¾— 5¼
5,000	10	5%	Do. Cum. Pref. 5%	10	9¼— 9½
186,748	Stk	4%	Do. Deb. 4%	100	93 — 95
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	11 — 12
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk .Red.	100	100 —103
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000	10	12¼—12½
6,000	10	5%	Do. 5% Cum. Pref. Nos. 9001/15000	10	9½—10
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord.	3	4 — 4½
21,000	3	1/6	Do. 7½% Cum. Pref,	3	5¾— 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7*
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red.	100	88½—89½*
16.800	10	10/-	Greenwood & Batley, Ltd., Ord.	10	5⅜—5⅝
9,600	10	7%	Do. 7% Cum. Pref.	10	10½ — 11
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2¼— 2⅜
344,000	5	2/6	Do. 5% Cum. Pref.	5	6¼— 6½
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	102 —104*
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2 — 3
250,000	1	3/6	Hadfield's Steel F'dry Co., Ld., Ord.	1	3½— 3⅝
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10⅛— 11*
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd.	1	1 3/16—1 5/16
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	97— 99*
28,001	5	7/-	Head, Wrightson & Co., Ltd.	5	4¾— 5¼*
85,000	1	7⅕d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	11/16— 13/16
18,000	5	3/-	Do. 6% Cum. Pref.	5	4¾— 5
£100,000	Stk	6%	Hornsby (Richard) & Sons, Ld., Ord. 6% Cum. Pref.	100	98—100

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
750,000	1	7½%	Howard & Bullough, Ltd., Ord.	1	1⅝— 1¾
25,000	10	6/-	Do. 6% Pref. (Non-Cum.)	10	13 — 13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	95 —98*
37,500	10	20	Kynoch, Ltd.	10	18 — 18½
49,537	10	5%	Do. Cum. Pref. 5%	10	10⅞— 11⅛
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	⅝— ⅞
50,000	5	2/9	Do. 5½% Cum. Pref	5	4 — 4½*
40,000	3	2/1⅕	Leeds Forge Co, 7% Cum. Pref.	3	3¾— 4
200,000	1	7⅕d	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16— 1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	107 —109*
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11½—12
210,000	1	8⅖d.	Measures Bros., Ltd., Ord.	1	⅝ — ¾
75,000	1	6⅗d.	Do. 5½% Cum. Pref.	1	13/16— 15/16
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95
21.943	5	2/6	Muntz Metal, Ltd.	5	4⅞— 5⅛
14,248	5	5%	Do. Pref. 5%	5	4⅞— 5⅛
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	79 — 81
78,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅛—12⅜
80,000	5	—	North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½%	4½% 1st Mrt. Db. Stk., Red.	100	88 — 91*
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅝— 3⅞
50,000	5	3/-	Do. 6% Cum. Pref. "A"	5	6¼— 6¾
70,000	10	6/-	Pease & Partners, Ltd., Ord.	10	9½— 10
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	97 —100
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	5 — 5¼
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord	1	6/- — 6/6
13,000	5	—	Do. 5½% Cum. Pref.	5	3⅞— 4⅛
230,000	1	—	Projectile Co. (1902), Ltd., Ord.	1	⅜ — ½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1¾— 2
73,062	5	2/-	Do. New	5	1⅝— 1⅞
£330,000	—	5%	Do. 5% Mort. Deb., Red.	100	99—101*
350,000	1	7⅕d.	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000	1	25/32— 27/32
£350,000	1	7⅕	Do. 6% Cum. Pref.	1	⅞ — 1
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock	100	93 — 95*
35,000	10	12/-	Ruston, Proctor & Co., Ltd.	10	9½— 10
275 000	1	6d.	Scott (Walter) Ltd., Ord.	1	⅝— ¾
300,000	1	7⅕d.	Do. 6% Cum. Pref.	1	⅞— 1
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	92 — 94*
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red	100	90 — 93*
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95*
250.000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	11/16— 13/16*
300,000	1	1/2⅖	Do. 6% Cum. Pref.	1	¾ — ⅞*
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	90 — 93*
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560	9	5⅝— 5¾
£125,240	Stk	5%	Do. 5% Trust Mort. Deb.	100	105—106
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2⅛— 2⅜
25,000	10	5/6	Do. 5½% Cum. Pref.	10	4 — 4½
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	75— 78*
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	17¾—18¼
55,000	10	6/-	Do. 6% Cum. Pref.	10	14¼— 14¾
634,782	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	¾— ⅞
538,845	1	6d.	Do. 5% Cum. Pref.	1	⅞ — 1
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	96 — 99*
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ — ⅝
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	76 — 80
£148,500	1	7⅕d.	Thornycroft (John I.) & Co., Ltd. Or.	1	⅝ — ⅞
£160,000	1	7⅕d.	Do. do. 6% Cum. Pref.	1	15/16 — 1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¼— 9¾*
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	35¼— 35¾
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	104½—105
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	97 — 99
3,350,000	1	1/6	Vickers, Sons & Maxim, Ltd. Ord.	1	2 7/16—2 9/16
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	1 3/16— 1 5/16
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	118 —121
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	104 —106
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	105 —107
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	13/16— 15/16
500,000	1	7⅕d.	Do. 6% Cum. Pref. Ord.	1	⅞— 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	83 — 87
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4½— 4¾
500	Stk	4½%	Do. Mort. Deb. 4½%	100	92 — 98
66,666	5	3/.	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2½— 3½
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	73 — 78
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	74 —76*

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝— ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	7/16— 9/16
120,000	1	1/2⅝	Bell's Asbestos Co., Ltd.	1	⅞— 1
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5½— 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½— 6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 —104*
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	100—102
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref. ..	5	2⅜ — 2⅝
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	87 — 89*
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½— ¾
150,000	2	2/4½	Do. 6% Pref.	2	1 — 1½
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92 — 95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	77 — 80*
35,000	5	7/6	Callender's Cable & Constn. Ltd. Ord.	5	10 — 11
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5½— 5¾
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	106 —108
85,000	3	1/6	Crompton & Co., Ltd...	3	1⅞ - 2⅛
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	94—99½*
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7¾— 8¼
61,000	5	8/-	Do. 6% Cum. Pref.	5	5¾— 6
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	104 —106*
283,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛— 1⅜*
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106 —109*
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1⅛— 1⅜
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	2 — 2½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	83 — 88*
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	89 — 94
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	¼— ¾
31,390	2	2/9⅜	Do. 7% Cumulative Pref. ..	2	1¾— 2¼
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	95 — 98
10,248	10	7/6	Evered and Co., Ltd...	10	11 — 13
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½— 10*
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	97—101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11½—12½
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅜— 5⅝
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15½ – 16½
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 —103
7,500	10	—	Parker, Thos., Ltd.	10	6½— 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3—16/9
37,350	12	24/-	Telegraph Construction and Maintenance Co., Ltd.	12	31 — 33
£150,000	100	4%	Do. 4% Deb. Bonds	100	101 —103*

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	8⅜— 8⅝
260,007	5	2/6	Do. 5% Cum Pf.	5	6 — 6¼*
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	13 — 14
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9½ -- 10*
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 --102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 —100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	¾— ⅞
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	15/16—1 1/16*
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1¼— 1¾
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾— 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	92 -- 96*
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	105 —108
		5%	Pref. Ord. Stock	100	98 —101
138,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¼— 9¾
156,437	10	6/-	Do. 6% Cum. Pref.	10	11⅛— 11⅝
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	122— 124
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	97 — 99
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3 — 3¼
40,500	5	8/-	Do. "A" 6% Cum Pref. ..	5	5 7/16—5 11/16
27,000	5	8/-	Do. "B" do.	5	5¼— 5½

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	96 — 98*
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	99 —102*
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	8¾— 9¼
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 --108*
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1¼— 1½
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4⅞— 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99 —102
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —103*
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½— 14½
59,987	10	6/-	Do. 6% Pref...	10	15 — 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2¾— 3¼
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	88 — 88*
125.000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	9½—10*
£1.031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —101*
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red.	100	101 —103*
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	9/32— 11/32
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 — 1 1/16
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	104 —106*
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½— 1½
110,923	8	3/2⅖	North Metropolitan Tramways Co..	8	4½— 5
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95*
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	103 —106*
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8¾— 9¼
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9¼ 9¾
£220.000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	101 —104

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11¾— 12¼
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	10— 10½
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11¾ – 12¼
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	106 —108*
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼— 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	103 —106
27,507	5	5/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	9 — 10
12,498	5	3/6	Do. 7% Cum. Pref. Shares..	5	9 — 10
60,000	5	5/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9½
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	103 —106
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	6½— 7½
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5½— 5¾
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	104 —106
41,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	5½- 6½
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108 —110*
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	10¾— 11¼
40,000	10	6/-	Do. 6% Cum. Pref.	10	13 — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	122 —126*
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 —105*
40,000	10	5/-	County of London Elec Supply Co., Ltd., Ord.	10	7½— 8½
30,000	10	6/-	Do. 6% Cum. Pref.	10	11½—12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	111 —114*
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5¾ - 6¼
70,000	5	8/-	Do. 6% Cum. Pref.	5	6 — 6¼
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	107 —109
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	85 — 90*
10,000	5	/6	Folkestone Elec. Supply Co., Ld., O.	5	5½ — 5¾
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 — 104
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9½— 10½
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7¾— 8¼
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	⅜—
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	10½— 11½

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	101 —103
111,000	[illegible]	1/9⅜	London Elec. Supply Corp., Ld., Ord.	3	2 — 2½
60,000	5	3/-	Do. 6% Pref.	5	5 — 5½
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 —101
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	9½ — 9¾
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅜ — 5⅝*
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —113*
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	98 —100*
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99—101%*
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14 — 15*
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6½ — 7
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	99½—101½
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 —104
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13 — 14
20,000	5	3/6	Do. 7% Pref.	5	8½ — 9
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	97 —99*
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅝ — 3⅛
£50,000	Stk	4%	Do. 4% Debenture Stk Red.	100	79 — 83
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	3½ — 4
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	¾ — ⅞
50,000	1	8⅖d.	Do. 7% Cum. Pref.	1	1¼ — 1⅜
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4⅝ — 4⅞
30,000	5	2/6	Do. 5% Cum Pref.	5*	5⅛ — 5⅜
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104—106
110,000	5	7/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	11½—12½
28,151	5	2/6	Do. 5% Cum. Pref.	5	6⅛ —6⅝

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	98 —101*
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ — 2¾
£763,580	Stk	15/-	Anglo-American Tel. Co., Ltd., Ord.	100	59 — 61
£3,118,210	Stk	30/-	Do. 6% Preferred Ordinary	100	106 —107
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	14½ — 14¾
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6⅞ — 7⅛
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	———
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	96½—98½*
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8 — 8½
6,000	10	10/-	Do. 10% Preference .. .	10	17 — 18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜ — 3⅝
		5/-	10% Cum. Preference	5	9 — 9½
£30,000	50	4½%	Do. 4½% Debs...	50	100-103%*
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11⅛—11⅜
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	99—101*
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100½—102½
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	100½102½%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13¾— 14¼
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 — 108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	141 —144
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	90 — 92
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	107 —109
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	34 — 35
£58 700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	99—101*
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	49¾— 51
72.680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	¾ — ⅞
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	111½—112½
£1,966 667	Stk	5%	Do. Deferred	100	103½—105½
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5½ — 5¾
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	99 —101*
£689,593	Stk	4%	Do. 4% do. do. ..	100	101½-103½*
179,313	1	8⅖d.	Oriental Telephone & Elec. Co., Ltd.	1	1⅛ — 1¼
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1 1/16—1 3/16
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	97 —100*
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7½ — 8
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	6¾ — 7¼
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5¼*
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	106—108*
15,609	10	5/-	W. African Telegraph Co., Ltd. ..	10	8½ — 9
£30,008	2½	—	West Coast of America, Ltd. ..	2½	7/16 — 9/16
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	99 —101*

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	½ — ⅝
84,568	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8 — 8½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	5¾ — 6¼
£80,000	100	5%	Do. 5% Deb.	100	101 —104*
207,980	10	3/-	Western Telegraph Co., Ltd. ..	10	13½ —14*
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	100 —102*
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	101 —103*

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8¾ — 9
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99—101
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	95 — 97*
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5¾ — 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	87 — 91*
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	99 —101*
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	12 — 12½
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4¾ — 5¼
£461,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	100—102
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1 3/16—1 5/16
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5½
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	8 — 8½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—102
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼ — 2¾
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2¾ — 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	86 — 88*
141,500	10	5/-	Leyland (Fredk.), & Co., (1900), Ltd., 5% Cum. Pref. ..	10	4 — 4½
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	128 —131
£1,160,000	Stk	19%	Do. do. Deferred ..	100	222 —225
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	29½ — 30½
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾ — 5¼
39,075	5	2/6	Do. "B" Ord... . ..	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼ — 8¾
24,000	10	4/6	Do. 4½% Cum. Pref.., ..	10	10¼ — 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	101 —103

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60 000	1	9⅗d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1¼—1½*
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	129 —134
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	½ — ⅝
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	⅝ — ⅞
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1 1/16 —1 3/16*
135,000	1	7⅕d.	Do. 6% Cum. Pref. ...	1	1⅛ — 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

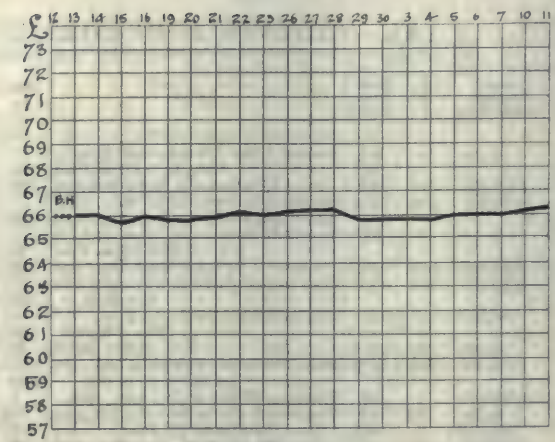
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	28 — 28½
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8¼ — 9¼
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13¾—14¼
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9¼ — 9¾
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4⅛ — 4⅜
14,567	10	1/3	Lancashire Wagon, Ord.	[illegible]	2⅜ — 2⅝
4,150	10	5%	Do. do.	10	10½—10¾
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	41/3--41/9
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/6--24/6
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	27/6-- 28/6
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 —19½

Stocks and Shares marked * are quoted ex-dividend.

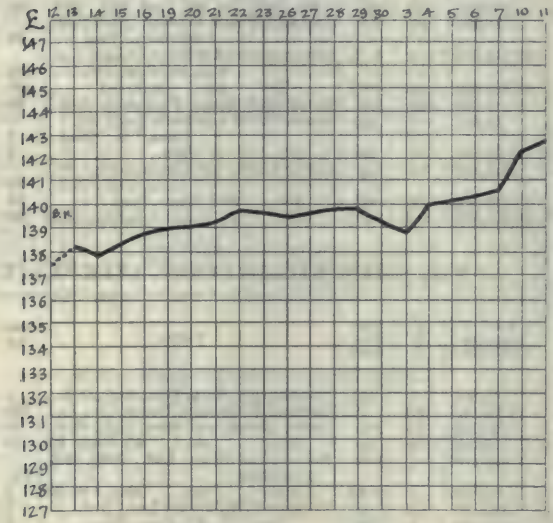
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM JUNE 12TH TO JULY 11TH, 1905.

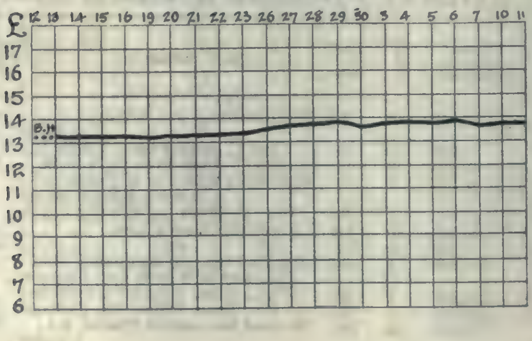
COPPER.



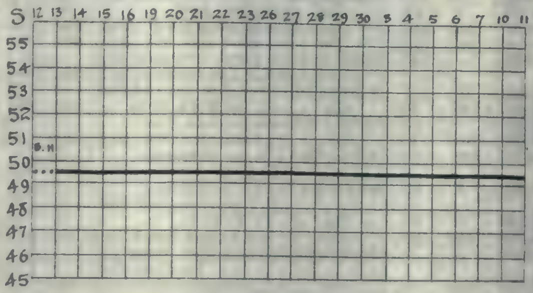
TIN.



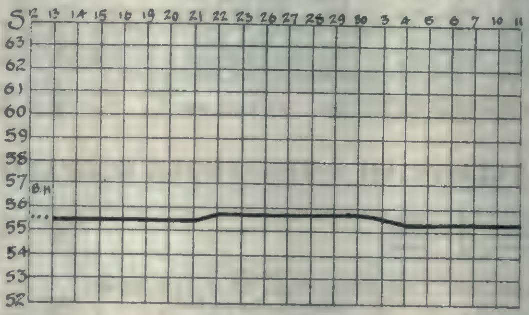
ENGLISH LEAD.



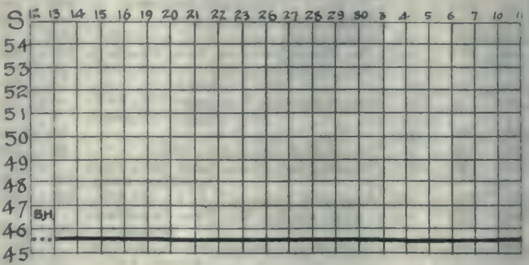
PIG IRON: SCOTCH,



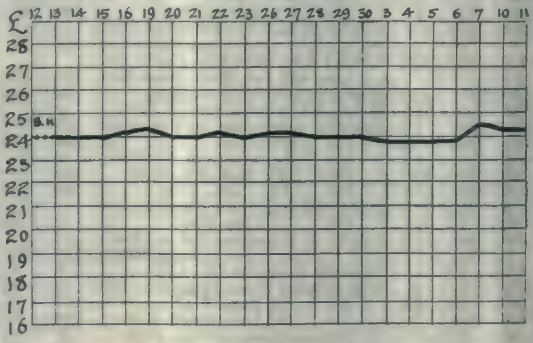
HEMATITE,



CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, July 12th, 1905.

DURING the week the market for Standard Copper has continued firm, values ranging between £65 15s. and £66 5s., but only a very moderate amount of business has been transacted. The political situation on the Continent has had its effect on this market and speculators cannot be induced to move in one direction or the other. Nor has the substantial increase in the visible supplies, chiefly due to the larger shipments from Australia, had any effect upon prices, and the market closes steady at £66 5s. od. cash and £65 7s. 6d. three months. The demand for refined copper has been of moderate dimensions.

Tin on American support and a good trade demand has made another jump. The statistics for June indicate a strong position, and although temporarily without effect on dealings, the outlook is now attracting both speculative purchasers and consumers. Another factor which has influenced quotations is the indisposition to offer metal from the Straits, and as a matter of fact competition for the Billiton, which was for sale at Batavia on the 5th was very keen, £140 being paid. The price on our own market is still rising, the closing quotations yesterday being £143 os. for cash delivery.

The position of the Lead market is referred to elsewhere in this issue. As Merton and Company's circular points out, the scarcity of prompt material has become acute and has forced those dealers who were short and unable to fulfil their obligations towards consumers, to pay increased prices for spot metal which was withdrawn from the London warehouses in important quantities. The supplies in sight are extremely limited, whilst consumption seems ready to absorb larger quantities than usual. The closing price is Foreign, £13 11s. 3d., and English, £13 16s. 3d.

Spelter remains steady and dealings have been of an unimportant character. The current quotation is £24 2s. 6d.

In the Iron and Steel market the deadlock still continues. Trading reports are better, and it is only the extraordinary position in the warrant market which prevents a rise in quotations. If the pig-iron trade is somewhat slow, steel rails are in good request and there is an excellent demand for structural steel. German advices report a brisk trade, but American reports are conflicting.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

Steel :

		£	s.	d.
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
♛♛	,, ,, ,, Land ,, ,, ...	6	17	6
STEEL	,, Steel Bars, Boiler Quality	6	17	6
DALZELL	Siemens' Steel Plates, Ship Quality Plates......	5	17	6
♛	,, ,, Bars ,, ,, ...	6	7	6
STEEL	,, ,, Angles..........	5	7	6

Manufactured Iron :

	£	s.	d.
Bars—Dalzell..	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle..........................	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

' Usual terms and extras. Special rates for delivery in England and export The above prices subject to alteration without notice

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

(Glasgow ♛ Steel)	£	s.	d.	
Steel Angles	5	7	6	per ton.
Steel Ship Plates	5	17	6	,,
Steel Bars, Ship Quality	6	7	6	,,
Glasgow ♛ ♛ Steel.				
Steel Bars, Boiler Quality	6	17	6	,,
Steel Land Boiler Plates	6	7	6	,,
Steel Marine Boiler Plates	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote :—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best..	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix	—		
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	3	5	0	2	13	0
Gartsherrie ,,	2	17	0	2	12	0
Summerlee ,,	2	17	0	2	12	0
Carnbroe ,,	2	14	0	2	12	0
Langloan ,,	3	0	0	2	15	0
Calder ,,	2	17	6	—		
Clyde ,,	2	16	6	2	11	6
Glengarnock, f.o.b. Ardrossan	2	17	0	2	12	0
Eglinton ,, ,,	2	12	6	2	10	0
Dalmellington, ,, Ayr	—			2	12	0
Shotts ,, Leith	2	17	6	2	12	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♛ Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby ♛	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. ♛ Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8-inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron.			Steel.		
		£	s	d.	£	s.	d
♛ (BNF)	Bars	6	10	0	6	15	0
	Angles	7	0	0	7	5	0
	Tees	7	10	0	7	15	0
♛ W.I.W	Hoops	7	0	0	7	10	0
	Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
Black Sheets	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,, ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	15	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	5	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	0	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ½ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote 'Star" brand patent wrought nails steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½-inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—
2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—
2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	12	0
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	0
C 20 by 14 112s. 108 ,, "Lydbrook"	0	11	9
C 28 by 20 112s. 216 ,, "Lydbrook"	1	3	9
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	6

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	3	16	0	per ton.
Billets	at	3	18	0	,,
Sheet Bars	at	4	0	0	,,
Finished Steel:					
Bars	at	5	0	0	per ton.
Angles	at	5	1	0	,,
Tees	at	5	4	0	,,
Joists	at	4	10	0	,,
Fencing Standards	at	5	2	0	,,
Shoeing Bars	at	5	5	0	,,
Tyre Bars	at	5	5	0	,,
Half-Round Bars	at	5	10	0	,,
Heavy Rails	at	5	5	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s		
English Ingots, f.o.b. Dis. 1¼% & 1%	143	0	0	to	143	10	0	per ton
English Bars, f.o.b. Dis. 1¼% & 1%	144	0	0	to	144	10	0	,,
Straits G.M.B., cash Warehouse, Net	142	15	0	to	143	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	140	15	0	to	141	0	0	,,
Australian, Mt. Bischoff, Warehouse, Net	144	0	0	to	144	10	0	,,

COPPER

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	66	5	0	to	66	7	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	66	7	6	to	66	10	0	,,
English, Tough, Cake & Ingot, Warehouses, Net	69	10	0	to	70	0	0	,,
English, Best Select, Warehouse Net	70	10	0	to	71	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	79	0	0	to	80	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	75	0	0	to	76	0	0	,,
Electro, Warehouse, Net	69	15	0	to	70	0	0	,,
Ore, ex. ship	0	11	9	to	0	12	9	per unit
Regulus, Matte and Precipitate, ex ship,	0	13	0	to	0	13	6	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6⅜	per lb.
Sheathing ,, ,,	0	0	6½	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	24	2	6	to	24	5	0	per ton.
Blende of 50 % Net	6	12	6	to	6	13	6	,,
Calamine, Net	6	15	0	to	6	16	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	13	15	0	to	13	17	6	per ton.
Spanish, ex ship, Dis. 2½%	13	10	0	to	13	12	6	,,
Lead Ore of 70 %, Net	6	14	6			—		

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	58	0	0	to	60	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	16	0	0	to	16	10	0	,,
Crude, ex ship, Dis. 2½ %	29	0	0	to	30	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	7	6	per flask
Italian ,, ,, ,,	7	5	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	6	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:	s.	d.
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	 d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	8

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL.	s.	d.
London Brights, 4 to 8 in. cube	9	6
Bright Cobbles (Hand Picked)	9	0
Large Nuts, 2 to 4 in. cube	8	0
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0
STEAM.—TOP HARD.		
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb.
Picric, Crystals	0	0	11	,,
Tartaric at Manchester	0	0	10⅞	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	9	15	0	per ton
Grey ,,	12	0	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
Sal-ammoniac, Lump, 1sts, del^{d.} U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	12	11	3	,,
Arsenic: Best White Powdered net	12	5	0	,,
Bleaching Powder, 35% ,,	4	10	0	,,
Borax: British Refined Crystal ,,	12	0	0	,,
Coal Tar Products:				
Benzole, 50/90 % ,,	0	0	6	per gal.
,, 90% ,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C. ,,	0	0	6¼	per lb.
,, ,, ,, 39/40° C. ,,	0	0	6½	,,
,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	9	,,
Creosote, ordinary good liquid ,,	0	0	1½	,,
Naphtha, Crude, 20 % at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8½	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10	,,
,, Rectified, flash point over 73° F. f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	0	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	7	0	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	19	0	,,
Cake ,,	1	2	6	,,
Copper: Sulphate	20	0	0	,,
Cyanides: 98% minimum f.o.b. net	0	0	7½	per lb.
Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	23	5	0	,,
,, ,, Grey	21	15	0	,,
,, ,, Brown at Manchester	16	15	0	,,
Nitrate	24	10	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p.	0	2	6	per gal.
Solvent	0	2	7	,,
Potash: Bichromate delivered England	0	0	3	per lb.
Carbonate, 90/92 % c.i.f Hull	18	5	0	per ton.
Caustic, 75/80 % ,, ,,	20	10	0	,,
Chlorate net	0	0	$3\frac{1}{16}$	per lb.
Montreal in Store, Liverpool	32	0	0	per ton.
Prussiate, Yellow net	0	0	4⅞	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary .. net	5	5	0	per ton.
	,, ,, ,, Refined ,,	6	5	0	,,
	,, Carbonated, 48 % ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % net	6	10	0	,,
	Caustic, White, 77 % ,,	10	10	0	,,
	,, ,, 70 % ,,	9	12	6	,,
	,, ,, 60 % ,,	8	12	6	,,
	,, Cream, 60 % ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate c.i.f. Hull net	16	15	0	,,
	Bicarbonate, in 1 cwt. kegs	6	15	0	,,
	Bichromate......delivered England...	0	0	2¼	per lb.
	Chlorate net	0	0	$3\frac{1}{16}$	per lb.
	Nitrate...ex quay Liverpool, ... ,,	11	2	6	per ton.
	Phosphate	9	5	0	,,
	Prussiate net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)	1	12	6	,,
	,, (Saltcake, 95%)	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot	7	10	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote :—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports	3	10	0	,,
Manganese:	Lump c.i.f. Liverpool 10¼d.				per metallic unit.
Ochre:	French JC f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk) c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote :—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	11	9	to	0	12	9	per unit.
Regulus, 45 to 55%	0	13	0	to	0	13	6	,,
Precipitate, 65 to 80%	0	13	1½	to	0	13	7½	,,
Tin Ores, 70 %	87	0	0	to	89	0	0	per ton.
Lead Ore, 70%					6	14	6	,,
Blende, 50%					6	13	6	,,
Calamine					6	16	0	
Antimony Ore, 50%	14	0	0	to	17	0	0	,,

Messrs. Barrington and Holt, Cartagena, quote :—

Iron Ore.

			s.	d.	
Ord. 50%,	f.o.b.	Porman	6	4	per ton.
Do.	,,	Cartagena	6	7	,,
Special low phos.	,,	Porman	6	10	,,
Do. do.	,,	Cartagena	7	0	,,
Extra quality do.	,,	,,	7	6	,,
Special Iron Ore	,,	,,	nominal		,,
Specular 58% do.	,,	,,		6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote :—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	3		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do.	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	2	6		7	7	6
Nova Scotia Spruce	,,	7	0	0		7	5	0
Spruce Boards	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak	per load	12	0	0		16	0	0
Greenheart	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak	,,	0	2	6		0	3	0
Norway Spars	,,	0	1	2		0	1	9

Deals.

		£	s.	d.	£	s.	d.
Red Archangel and Onega, 1st quality	per std	19	0	0	20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0	16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0	12	10	0
St. Petersburg, 1st quality...	,,	16	0	0	17	10	0
Do. 2nd ,, ...	,,	14	0	0	15	0	0
Gefle	,,	11	10	0	16	0	0
Wyburg	,,	11	0	0	12	10	0
Uleaborg	,,	10	0	0	12	10	0
Gothenburg	,,	11	0	0	16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics*.

13000. M. Warren, London. June 19th.—Improvements in valves.

13016. N. Crapper, Sheffield. June 19th.—Improvements in portable gas boilers.

13017. G. M. Roberts, London. June 19th.—Improvements in valve gear for steam engines and the like.

13019. R. Rappaport, Liverpool. June 19th.—Improvements in gas turbines. (Date applied for, June 24th, 1904.)

13020. R. Rappaport, Liverpool. June 19th.—Improvements in pressure turbines. (Date applied for, June 24th, 1904.)

13095. C. R. Winn and A. Mousley, Birmingham. June 19th.—Improvements in safety valves for steam boilers.

13126. J. M. Sanderson, Newcastle-on-Tyne. June 26th.—Road maker and repairer.

13133. C. W. J. Fish and E. T. Rossiter, Leeds. June 26th.—Improvements in means or apparatus for automatically closing the doors or gates of hoists or elevators, and for securing them in a closed position.

13134. G. D. Drummond, London. June 26th.—Improvements in wrenches.

13141. G. L. Hoffmann, Germany. June 26th.—Process for the manufacture of a substance to be used for the improvement of inferior qualities of steel.

13145. J. E. Boaz, Acton, W. June 26th.—Improvements in apparatus for heating water by steam.

13165. S. Busetto, London. June 26th.—Improved apparatus for separating and collecting oil from the feedwater of steam boilers.

13166. F. Syberg, London. June 26th.—An improved steam pump.

13171. A. F. Sandland and W. G. Martin, London. June 26th.—Improvements in fasteners for driving belts.

13172. J. B. Purdy, London. June 26th.—Improvements in triple valves. (Date applied for, August 9th, 1904.)

13185. C. Lemale, London. June 26th.—Improvements in or relating to turbines. (Date applied for, June 28th, 1904.)

13192. A. E. Howarth, London. June 26th.—An improved chain wrench. (*J. J. May, Canada.*)

13195. G. Wilson, Sheffield. June 27th.—Improvements in the arrangement and construction of rotary pumps.

13204. R. Frey, Manchester. June 27th.—Improvements in and connected with variable speed gears.

13205. M. Pedersen, Dursley. June 27th.—Arrangements to prevent explosions.

13210. W. Hasluck, London. June 27th.—Improvements relating to silicate cotton or slag wool strips or cloth, and like fibrous materials for the covering of boilers, steam pipes, and all analogous purposes.

13217. M. Hughes, London. June 27th.—Improvements in connection with the teeth of steam shovels. (*J. A. McCaskey, U.S.A.*)

13248. J. M. Colman, London. June 27th.—Improvements in steam boilers.

13251. T. G. Lovegrove, London. June 27th.—Improvements relating to dampers for steam-generator furnaces and the like.

13253. L. A. Mazellier, London. June 27th.—Improvements in pressure gauges.

13262. A. H. Crockford, London. June 27th.—An improved construction of steam, internal combustion, or other like reciprocating engine.

13272. G. S. Dobrashian, London. June 27th.—A new motive fluid for vapour engines.

13292. H. Cruse, Manchester. June 28th.—Improvements in the construction of valve casings.

13303. W. G. Potter, Liverpool. June 28th.—Improvements in steam-generator furnaces.

13320. T. F. J. Truss, London. June 28th.—Improvements in or relating to steam generators.

13345. L. C. Auldjo, London. June 28th.—Improvements in steam boilers.

13352. Gasmotoren-Fabrik Deutz, London. June 28th.—Improved method of working turbines operated by the combustion of gases. (Date applied for, July 2nd, 1904.)

13410. P. A. Roban, London. June 29th.—Duplex safety water columns for steam boilers.

13411. W. G. Potter, Liverpool. June 29th.—Improvements in fluid pressure turbines.

13415. W. West, Roundhay. June 29th.—Improvements in the means or devices for propelling ships or boats.

13439. F. A. Willett and G. E. Arnold, London. June 29th.—Improvements to and in connection with submarine boats.

13469. R. Schulz, Liverpool. June 29th.—Improvements in oil separators for steam pipes. (Date applied for, August 3rd, 1904.)

13473. A. Stodola, London. June 29th.—Improvements in explosion gas turbines. (Date applied for, July 4th, 1904.)

13477. A. E. Parker, London. June 29th.—Improvements in and relating to the firing of furnaces of steam generators and the like.

13504. S. Cowper-Coles, London. July 1st.—Improvements in pumps.

13532. F. A. Willett and G. E. Arnold, London. July 1st.—Improvements to and in connection with submarine boats.

13593. Deutsche Oesterreichische Mannesmannrohren Werke, London. July 1st.—An improvement in steam boilers. (Date applied for, May 12th, 1905.)

13610. R. Scheliga, Kingston-on-Thames. July 1st.—An improved fire-box for steam generators. (Date applied for, July 2nd, 1904.)

RECENT SPECIFICATIONS.

VARIABLE SPEED GEARING.

T. L. and T. J. Sturtevant, Boston, U.S.A. May 25th, 1905.—This invention has for its object to provide a centrifugally-controlled clutch device for transmitting power from a driving to a driven shaft at different speeds, but in which, when the duty or torque of the driven shaft exceeds a predetermined limit, the low-speed and high-power gearing will transmit motion to the driven shaft without necessarily reducing the speed of rotation of the flywheel clutch device, or of the motor or driving shaft from which power is derived. In the accompanying drawings fig. 1 is a sectional view of a clutch device power-transmitting mechanism embodying the present invention, and fig. 2 is an elevation partly in cross-section. The drawings show a portion of a motor shaft or power shaft, attached to which is a flange secured by screws or bolts to a hollow flywheel or casing, preferably formed in two parts screwed together, as shown, and enclosing the centrifugally-controlled clutch device, through which power is transmitted from the flywheel or clutch casing to the driven shaft, which latter may be used for driving an automobile, or for any other desired purpose. Clutch devices shown are of the multiple-disc or multiple-ring type, comprising of flat rings or annular plates notched at their peripheries for engagement with suitable projections or parts of the flywheel, and the other flat rings or annular plates shown will co-operate frictionally with the first-mentioned rings or plates in transmitting power to the driven shaft. To this end the rings or plates are notched at their inner edges for engagement with an arm of a sleeve carrying a pinion, which meshes with a gear ring connected by a silent ratchet with a hub keyed to a counter-shaft carrying a gear-wheel, which meshes with a gear-wheel on a sleeve loose on the driven shaft. In employing two clutch devices, in accordance with the present invention, the low-speed clutch device will first be brought into action, to transmit power, when the driving shaft or motor is started and is running at a low speed; but when the speed of the motor or driving shaft is increased so as to exceed a certain predetermined limit, the high-speed clutch device will be automatically thrown into operation. If, however, while the driving shaft is still running at a high speed, the load on the driven shaft exceeds a certain predetermined limit, so as to be in excess of a certain predetermined torsional strain, the high-speed clutch device will automatically be thrown out of action without necessarily requiring a decrease of the speed of motor or driving shaft to effect this result, and power will then be transmitted to the driven shaft through the low-speed gearing, which will be operated from the still rapidly running driving shaft or motor.

Fig. 1.

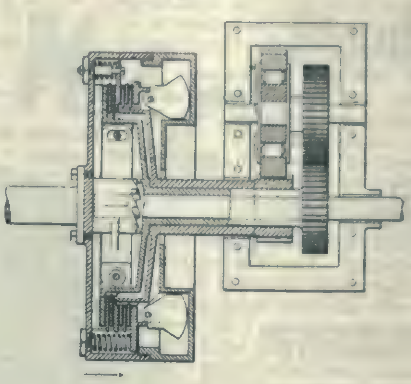
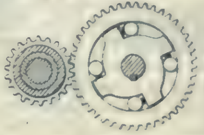


Fig. 2.



"AN IMPROVED METHOD OF MEANS FOR SOFTENING WATER."

Messrs. Mather and Platt, Ltd., and G. G. Hepburn, Manchester. June 8th, 1905.—In treating hard water, by the addition of lime and alkali, for the purpose of precipitating the hardness contained therein, a considerable time is requisite to allow the precipitate to form, and even after the lapse of some time a considerable percentage of the hardness may remain in the water. This invention relates to an improvement in the well-known Clark's process of softening water, and in carrying out same use is made of rough metallic surfaces, such as occur in metallic borings and turnings, or may be produced in metal plates by perforating them with holes having jagged edges, all such surfaces having a great number of points and jagged teeth, over or through which the water to be treated is passed, after the addition thereto of lime and alkali, and preferably after a preliminary settlement of the precipitate has taken place, whereby the precipitation of the remaining hardness is assisted and accelerated. The metallic borings and turnings, or the like, may be contained in layers or beds in any suitable receptacle, which may have a bottom plate perforated, as above described.

NEW PUBLICATIONS.

"THE METALLURGY OF STEEL."

By F. W. Harbord, A.R.S.M., F.I.C., with a section on the Mechanical Treatment of Steel. By J. W. Hall, A.M.Inst.C.E. The Metallurgical Series, Edited by Prof. Sir W. Roberts-Austen, K.C.B., P.R.S. Second Edition. Charles Griffin and Co., Ltd. 25s. net.

The fact that the second edition of this excellent treatise has already been called for, is by no means surprising, for probably there is no work which covers more comprehensively, from a metallurgical and engineering standpoint, the varions branches of steel manufacture. To this new edition a chapter on electric smelting, with sketches of the chief types of furnaces which are at present producing steel on a commercial scale, has been added, and signs of careful revision are not wanting. The first section of the work deals with the theory and practice of the manufacture of steel, particular attention being given to recent developments in steel manufacture, both in the United States and on the Continent. The latest types of steel furnaces, gas producers, mechanical appliances, as well as Bessemer and open hearth and crucible plants, are fully described and illustrated by scale drawings, which to the student should prove of much value. Section II. is devoted to reheating furnaces and the handling of material, and descriptions are given of the most recent types of coal and gas-fired furnaces. Then follows the part for which Mr. J. W. Hall is responsible—the mechanical treatment of steel. This section describes rolling, forging, wire-drawing, fluid compression and the protection of steel from corrosion. The fourth part, which is devoted to finished steel, deals with the testing of the various finished materials, and describes some of the leading types of testing machines. The influence of impurities on the mechanical properties of steel are discussed, and a chapter is alloted to special steels. Full consideration is given to the heat treatment of steel, and the method of using and the details of the latest form of pyrometers are described. The concluding chapter is devoted to the microscopical examination of steel, attention is given to the preparation of samples, different methods of research, etc., and a collection of interesting photomicrographs of steel is included. The volume covers a large ground, but every chapter appears to have been written with the same elaborate care and precision.

BOOKS RECEIVED.

"Hydraulic Power Engineering: a practical manual on the concentration and transmission of power by hydraulic machinery." By C. Croydon Masks. Second Edition. Crosby, Lockwood and Son. 10s. 6d. net.

"Electric Railways, Theoretically and Practically Treated." By W. Ashe and J. W. Keiley. Archibald Constable and Co. 10s. 6d. net.

"Bulletin of the Geological Institution of the University of Upsala." Vol. 4. Edited by H. Sjögren.

"Builders Quantities, for Foundations, Windows, Doors, etc." Edited by Paul N. Hasluck. Cassell and Co. 6d.

"Journal of the Institution of Electrical Engineers." Edited by George C. Lloyd. E. and F. N. Spon. 5s.

"Clay Modelling and Plaster Casting." Edited by Paul N. Hasluck Cassell and Co. 1s.

"Practical Plumbers' Work." With numerous engravings and diagrams. Edited by Paul N. Hasluck. Cassell and Co. 2s.

"Proceedings of the Engineering Association of New South Wales." Vol. XVIII. Edited by Henry V. Ahrbecker, The Royal Exchange, Sydney.

"History of the Coolgardie Water Supply Scheme." Second Edition. James Simpson and Co., Ltd.

NEW CATALOGUES.

Mavor and Coulson Ltd., Glasgow. We have already drawn attention to the card series issued by this firm, comprising a calendar for the month and the tabulated analyses of work done by the Pick-Quick Electric Coal Cutter. The obverse of the July calendar just to hand shows what this particular coal-cutter is doing in Scotland and gives a specimen machineman's daily report.

William Asquith, Ltd., High Road Well Works, Halifax. List No. R4 describes and illustrates the firm's new patent-radial drilling, boring, tapping, and studding machines. The devices embodied include speed and feed gear boxes, a handy arrangement of tapping and other motions for easy and rapid manipulation effecting a great saving in time. Other features specified are an alteration of arm and slide so as to ensure central spindle thrust and eliminate side twisting strains, an arm of special section to resist lifting stresses; automatic trip motion, etc. The machines are suitable for taking full advantage of high speed drilling.

Percy Pitman, Bosbury, Ledbury, describes in a circular his "Hector" water motor, designed for the driving of every description of small machinery. The motor is fitted with an improved Pelton water-wheel enclosed in a cast-iron case with removable cover. Each motor is supplied with three nozzles, which can be changed instantly, giving a useful range of power. The steel shaft is prolonged on the opposite side to receive an additional pulley wheel if required. We gather that the motor is made in eight sizes giving from $\frac{1}{80}$ to $2\frac{1}{2}$ h.p., at 80 lb. working pressure or from $\frac{1}{30}$ to 2 h.p. at a pressure of 40 lb. Another circular deals with the "Hector" water motor and dynamo as used for charging accumulators.

Masons Gas Power Company, Ltd., Levenshulme, Manchester, forward an advance copy of a well printed and illustrated catalogue dealing with Producer Gas for Furnace Work and for Gas Engines, the Duff and Whitfield Patent Gas Producers, and the Weardale Patent Furnace (gas-fired). The earlier pages are devoted to a description of the firm's new works. These we are informed have been specially designed and erected to meet the increasing demand for gas producing plants. About eight acres of land were secured for the purpose, the works being situated alongside the main line of the London and North-Western Railway. The offices cover an area of 55 ft. by 65 ft., and are well designed. This block is heated on the "Plenum" system, and lighted by electricity. The main erecting shop is 220 ft. long by 50 ft. wide, is served by a 10-ton electric traveller and jib crane, and equipped with Pneumatic Plant and the usual tools for high-class constructional work. The machine shop is 125 ft. by 27 ft. wide, the plate and angle bending shop being 80 ft. long by 27 ft. wide In the latter shop is a gas-fired "Weardale" Patent Furnace for reheating plates, etc. The blacksmith shop is 50 ft. long by 24 ft. wide, and is fitted with down draught forges and the usual appliances of an up-to-date smiths' shop. Stores of ample capacity are provided for castings, finished work, and general stores. The pattern shop is 90 ft. long by 27 ft. wide, with gallery for storing patterns. The tools and machines throughout the works are independent and electrically driven, The gas producer plant is in two units each of 250 h.p., one supplying power to the engines for generating the electricity for driving the machinery and lighting the works, whilst the second producer supplies gas to the "Weardale" Patent Reheating Furnace.

PAGE'S WEEKLY Miscellaneous

Field IGRANIC Regulators

Represent the

HIGHEST GRADE

Type of

DYNAMO FIELD CONTROL

Leaflet P.W. 31.

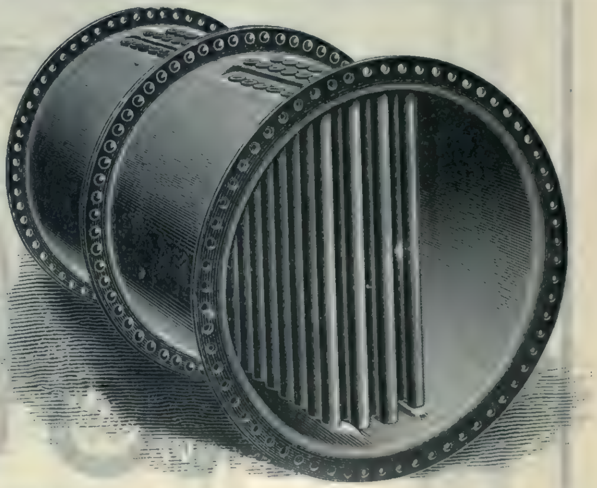
STURTEVANT
ENGINEERING Co., Ltd.,
147, QUEEN VICTORIA STREET, E.C.

and contain **PERFECTED** details of Construction **UNOBTAINABLE** in any other **FIELD REGULATOR** made.

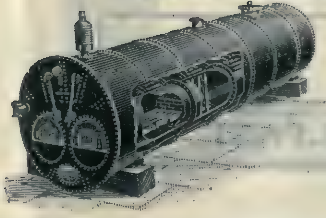
To Steam Users.

Economy in your Fuel account guaranteed by using Premier Boiler Tubes. These Tubes can be fitted to any Lancashire Boiler, and will **INCREASE** the evaporative efficiency

20 per Cent.



Part view of Flue fitted with PREMIER TUBES.



For Particulars apply to the Secretary—

The Premier Boiler Tubes, Ltd.,

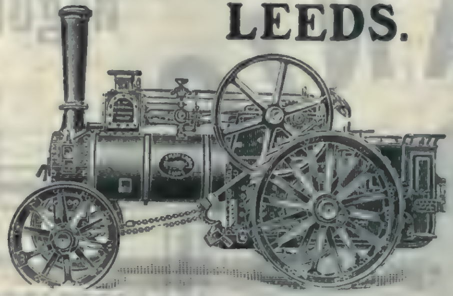
28, VICTORIA STREET,
LONDON, S.W.

Telephone No: 1638 VICTORIA.
Telegrams: "TUBULE, LONDON."

PAGE'S WEEKLY Locomotives &c.

McLAREN'S Traction Engines, LEEDS.

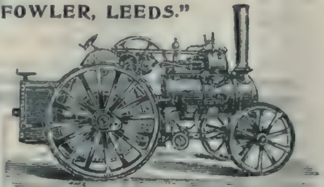
Cable Address: "McLAREN, LEEDS."
Codes used: A B C 4th and 5th Editions. LIEBER'S.



Catalogues and Pamphlets mailed free on application to—
J. & H. McLAREN, Midland Engine Works, LEEDS.

JOHN FOWLER & CO. (Leeds), Ltd.
Steam Plough Works, LEEDS.
Telegrams: "FOWLER, LEEDS."

Manufacturers of
Traction Engines,



Steam Rollers, Portable Railways, &c., &c.

BALDWIN LOCOMOTIVE WORKS.

BROAD AND NARROW GAUGE

Locomotives

SINGLE EXPANSION & COMPOUND

Mine, Furnace and Industrial Locomotives.

Electric Locomotives with Westinghouse Motors and Electric Trucks.

Burnham, Williams & Co., Philadelphia, Pa., U.S.A.
Cable Addresses: "Baldwin, Philadelphia"; "Sanders, London." General Agents: SANDERS & CO., 110, Cannon St., London, E.C.

More durable than iron. Cheapest for all spans up to 100 Feet.

D. ANDERSON & SON, Ltd.,
LAGAN FELT WORKS.
BELFAST.

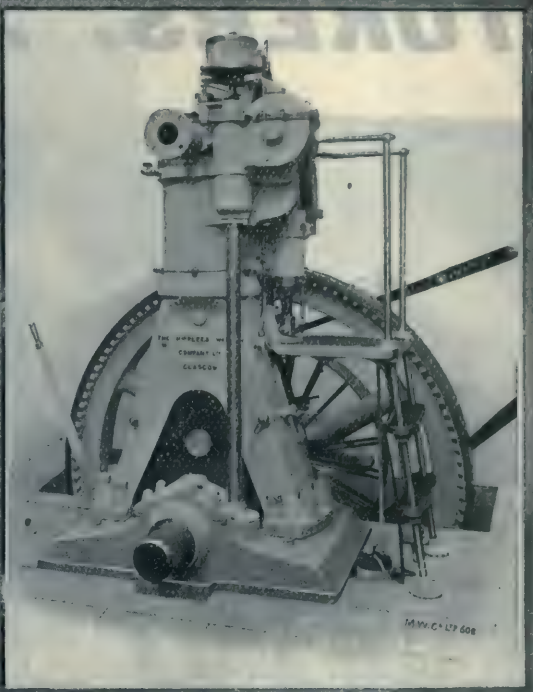
PAGE'S WEEKLY Oil Engines

THE MIRRLEES WATSON CO. LTD

GLASGOW.

LONDON OFFICE: 158 GRESHAM HOUSE OLD BROAD STREET, E.C.

THE DIESEL OIL ENGINE



IT IS THE MOST ECONOMICAL ENGINE MADE AND IS MORE RELIABLE THAN ANY OTHER OIL ENGINE.

PAGE'S WEEKLY **Stokers**

"MELDRUM" Mechanical STOKERS. .

EFFICIENT,
ECONOMICAL,
SMOOTH RUNNING,
SMOKELESS.

PHOTO OF A RANGE OF LANCASHIRE BOILERS.

Fitted with the "Koker" Stoker and "Meldrum" Draught. Twenty-two Boilers have been fitted for this firm.

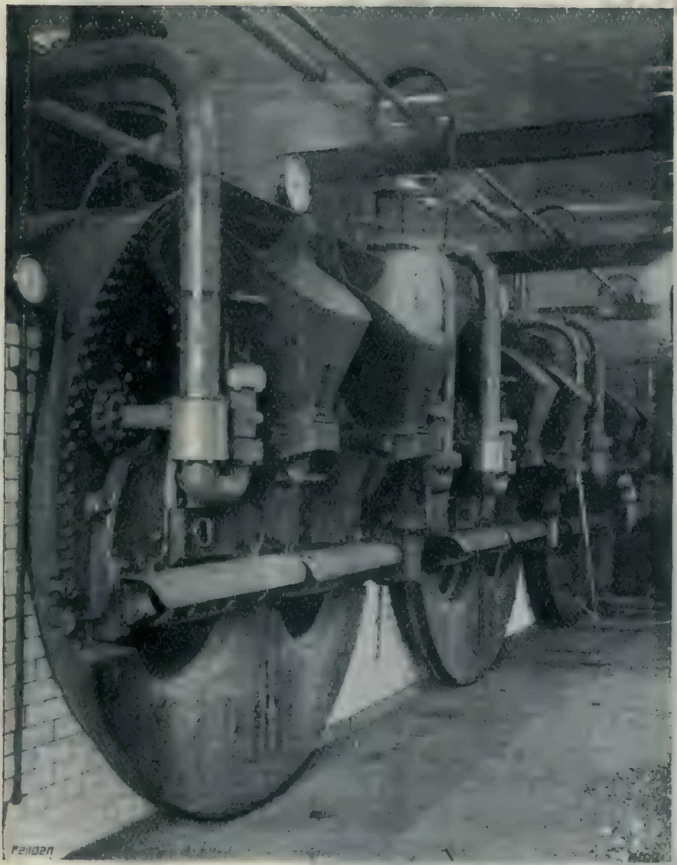
Write for Copy of Booklet, just published, to—

MELDRUM BROS., Limited,
Timperley, MANCHESTER.
London Offices: 66, VICTORIA STREET, WESTMINSTER.

BENNIS STOKERS

AND

Compressed Air Furnaces.



Photograph of Boiler House in a Cotton Mill, showing Bennis Stokers and Compressed Air Furnaces.

Smokeless,

Efficient,

Reliable and

Economical.

ED. BENNIS & CO., LTD.,

Little Hulton Iron Works,
BOLTON.

ALSO AT
LONDON, GLASGOW, NEWCASTLE-ON-TYNE, &c.

PAGE'S WEEKLY Valves

HUNT & MITTON'S

IMPROVED BATH SUPPLY VALVES

Suitable for Public Baths, Asylums, or Institutions.

CHIEF FEATURE.—Only one handle to operate.

Makers of . .

Improved Waste Valve and Shower Bath Valve.

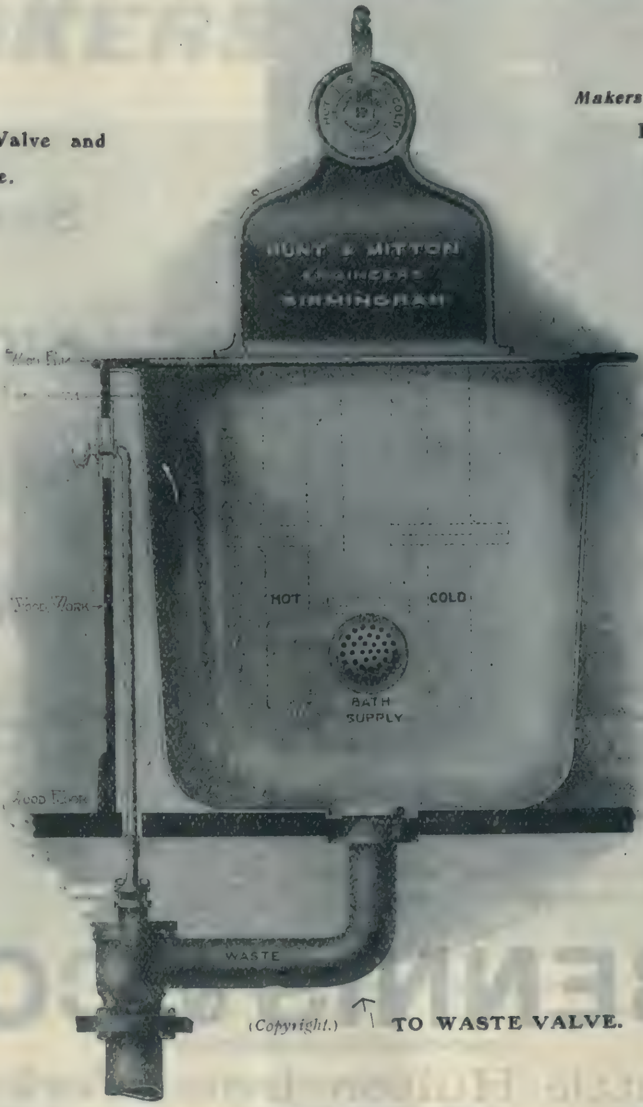
Water Heaters, Injectors, Ejectors, &c.

Revolving Water Sparger and Shower Bath.

Laundry Fittings.

Steam and Hydraulic Valves and Fittings.

Fire Pumps and Appliances.



(Copyright.) ↑ TO WASTE VALVE.

Makers of . .

Lubricators, Oil Pumps, Oil Boxes, Grease Cups, &c.

Instantaneous Hose Couplings.

Hydrants.

Copper Branch Pipes and Stand Pipes.

Complete Fire Equipments.

Landing Valves, Sluice Valves, Scaling Hooks, Scaling Ladders, &c., &c.

HUNT & MITTON, ENGINEERS, BRASSFOUNDERS, &c.,

Crown Brass Works, Oozells Street North,

Birmingham.

Telephone No.: 394.
Telegraphic Address: "MITTON, BIRMINGHAM."

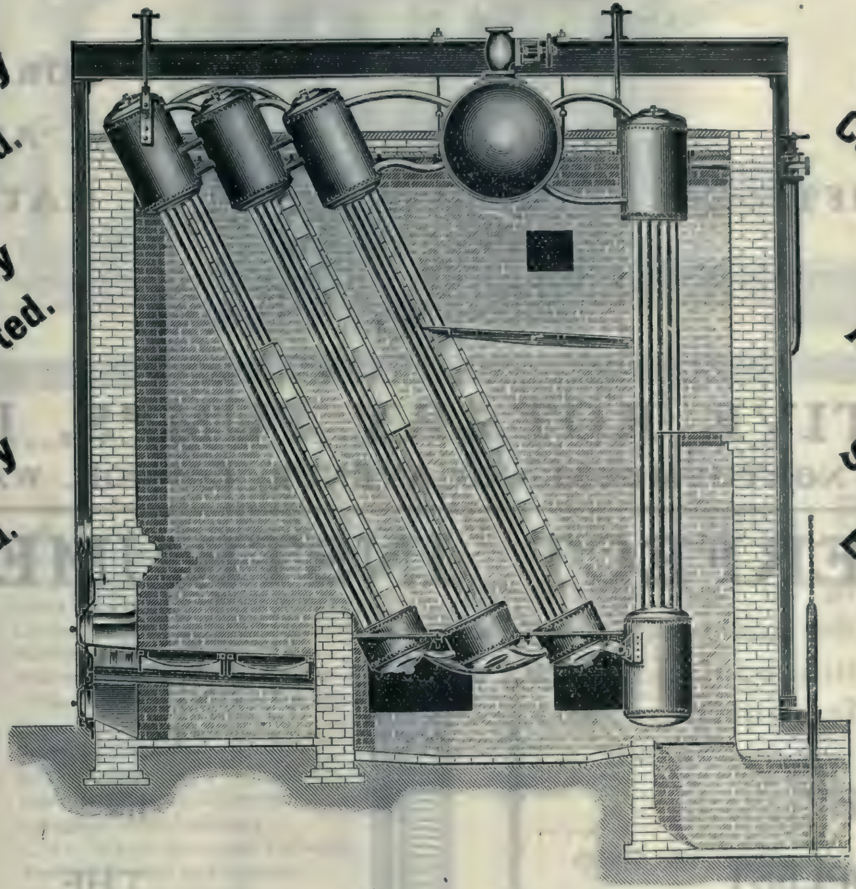
RICHARDSONS, WESTGARTH'S

"NESDRUM" WATERTUBE BOILER.

Rapidly Erected.

Cheaply Transported.

Quickly Cleaned.



Strongly Constructed.

Easily Accessible.

Simple, Safe, Economical.

MADE IN ALL SIZES TO EVAPORATE 3,000 TO 50,000 LBS. OF WATER PER HOUR.

RICHARDSONS, WESTGARTH, & CO., Ltd.,

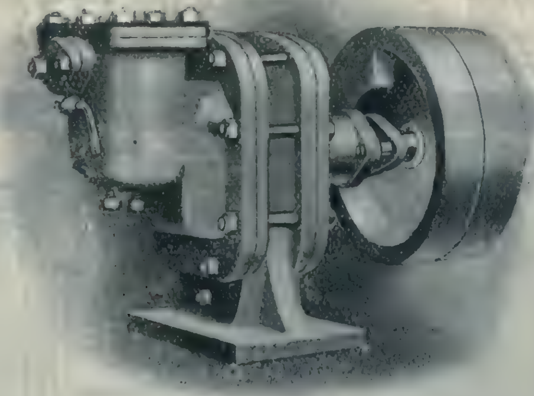
HARTLEPOOL.

PAGE'S WEEKLY Pumps, Condensers, &c.

The Best Industrial Pump in the World

FOR ANY DRIVE.

FOR
ANY
LIFT.

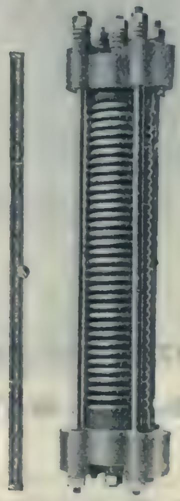


FOR
ANY
MATERIAL.

POSITIVE ROTARY PUMPS, LTD.,
23, NORTHUMBERLAND AVENUE, LONDON, W.C.

A PERFECT INSTRUMENT.

THE
SIMPLEST
CONDENSER



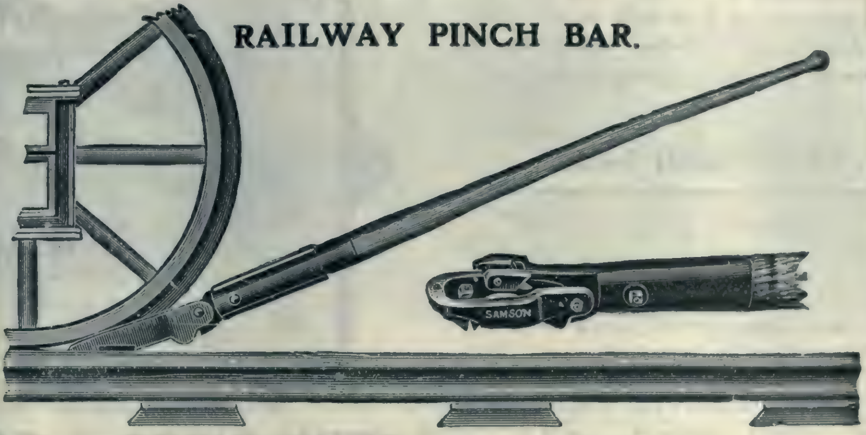
IN
THE
WORLD.

CONCENTRIC CONDENSER, LTD.,
23, Northumberland Avenue, LONDON, W.C.

PAGE'S WEEKLY Railway Pinch Bars

The "SAMSON."

RAILWAY PINCH BAR.



A Few of the Users of the "Samson" Pinch Bars :—

- Cambrian Railways.
- Cork, Bandon & South Coast Railway Co.
- Donegal Railway Co.
- Great Northern Railway Co.
- Great Southern and Western Railway Co.
- London and North Western Railway Co.
- Midland Railway Co.
- Midland Railway Co., N.C. Committee.
- Bolckow Vaughan & Co.'s Collieries.
- Grassmoor Collieries.
- Garforth Collieries.
- Henry Briggs, Son & Co., Ltd.
- Hoyland Silkstone Collieries.
- Houghton Main Collieries.
- J. & G. Wells' Eckington Collieries.
- Micklefield Coal and Lime Co.
- Mitchell Main Collieries.
- Shireoaks Collieries.
- Sheepbridge Co., Iron and Steel Works
- Staveley Iron and Coal Co.

The "Samson" Pinch Bar

Is used as a great labour-saving tool where wagons or locomotives require moving short distances.

OUR OFFER:—

SPECIMEN BAR SENT ON SEVEN DAYS' FREE TRIAL CARRIAGE PAID BOTH WAYS.

SAMSON & CO.,

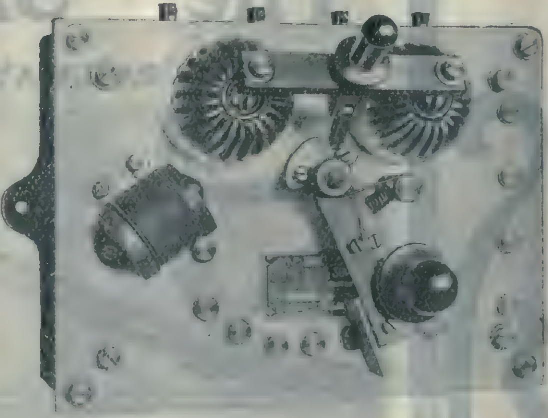
Garforth, near LEEDS.

JOHN GIBBS & SON'S Patent Safety Interlocking Double Pole Quick Break Regulating Switch.

This Switch provides, at a very low cost, the means of starting and regulating our Fans with perfect safety even in inexperienced hands, **it being impossible to turn on the power** without all the resistance being in circuit.

Prices of Patent Safety Switch.

Size of Fan.	Voltage.	Price.		
		£	s.	d.
15 in.	100 to 110 volts.	3	0	0
,,	200 to 250 ,,	3	1	0
18 in.	100 to 110 ,,	3	1	6
,,	200 to 250 ,,	3	2	0
24 in.	100 to 110 ,,	3	3	0
,,	200 to 250 ,,	3	4	0
30 in.	100 to 110 ,,	3	4	6
,,	200 to 250 ,,	3	5	0



Telephone: **2579** Royal.

JOHN GIBBS & SON,
80, Juke Street,
LIVERPOOL.

Telegrams:
"Ventilation, Liverpool."

ON ADMIRALTY AND WAR OFFICE LISTS.

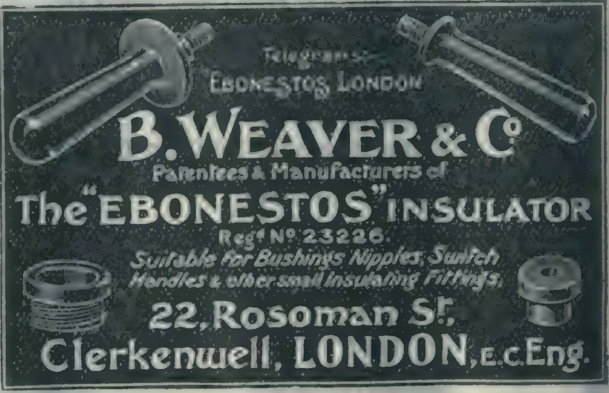
Write for Prices and Particulars
.. OF OUR ..
NEW "STANDARD" MACHINES.

They will interest you.

Dynamos "P.D.M." Motors

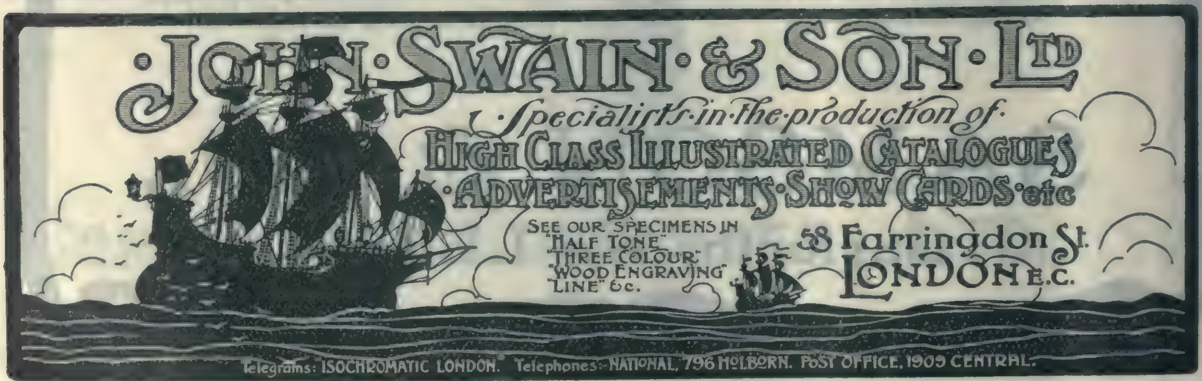
BEST MATERIAL, WORKMANSHIP, AND DESIGN.

PHŒNIX DYNAMO MFG. CO., Ltd.,
Thornbury Works, BRADFORD.
LONDON OFFICE: 17, Victoria St., Westminster, S.W.
Telegraphic Address: "Phedyna, London." *Telephone*: [illegible] Victoria



Telegrams:
EBONESTOS, LONDON

B. WEAVER & Co
Patentees & Manufacturers of
The "EBONESTOS" INSULATOR
Regd No. 23226.
Suitable for Bushings Nipples, Switch Handles & other small Insulating Fittings.
22, Rosoman St.,
Clerkenwell, LONDON, E.C. Eng.



JOHN SWAIN & SON LTD
Specialists in the production of
HIGH CLASS ILLUSTRATED CATALOGUES ADVERTISEMENTS SHOW CARDS etc
SEE OUR SPECIMENS IN "HALF TONE" "THREE COLOUR" "WOOD ENGRAVING" "LINE" &c.
58 Farringdon St.
LONDON E.C.
Telegrams: ISOCHROMATIC LONDON. Telephones:- NATIONAL, 796 HOLBORN. POST OFFICE, 1909 CENTRAL.

PAGE'S WEEKLY Engineers' Appliances

A Section of Our New Expansion Cabinets.

ORNAMENTAL

USEFUL

WE CAN HELP YOU TO SAVE EXPENSES,
THAT'S ALL—BUT IT'S ENOUGH.

THE LYLE COMPANY, LIMITED,
HARRISON STREET, GRAY'S INN ROAD,
LONDON, W.C.

Electric Impulse Clocks

NO WINDING UP.

For ACCURATE TIME-KEEPING

In all the various departments of large establishments. Suitable for

TURRET, WAREHOUSE,
OFFICE,
PRIVATE RESIDENCE,
Or any other position.

Perfect and Uniform Time
At all Points.

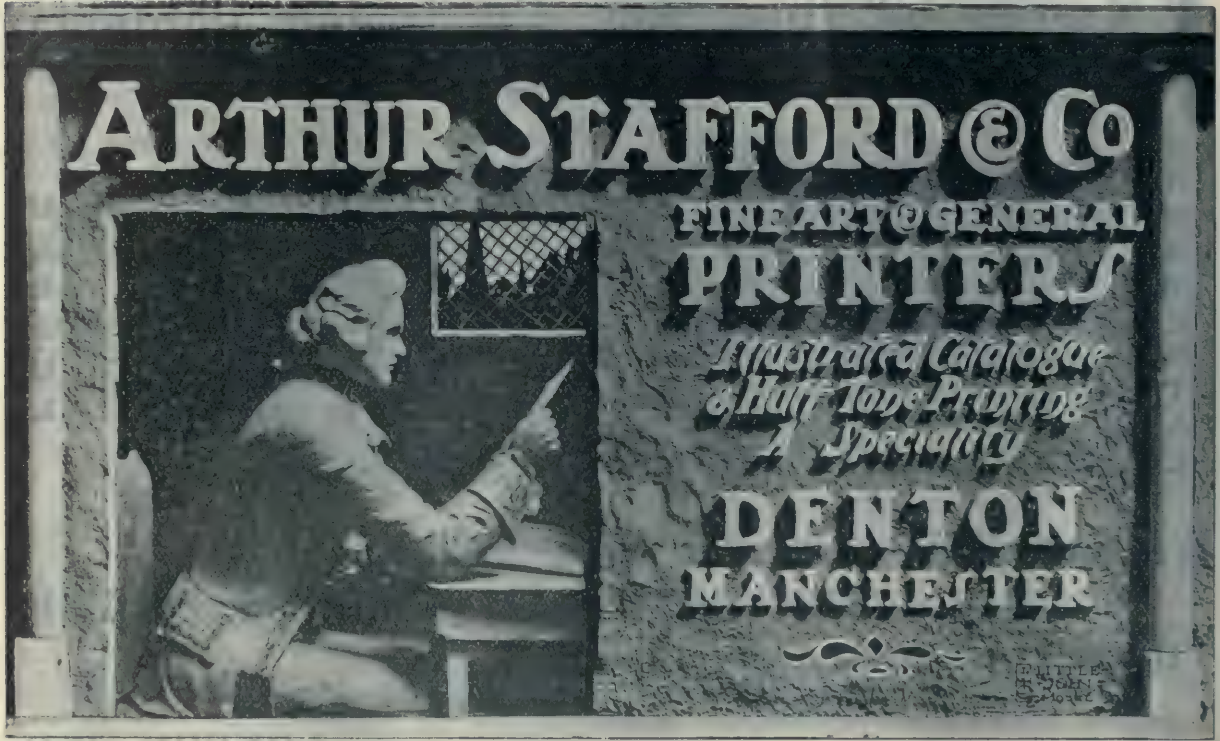
PATENTEES AND SOLE MAKERS:—

GENT & CO., Ltd.
FARADAY WORKS,
LEICESTER.
And 3a, Upper Thames Street, LONDON, E.C.

NO ATTENTION NEEDED.

SEND FOR CATALOGUE C.P.

PAGE'S WEEKLY Printing, &c.

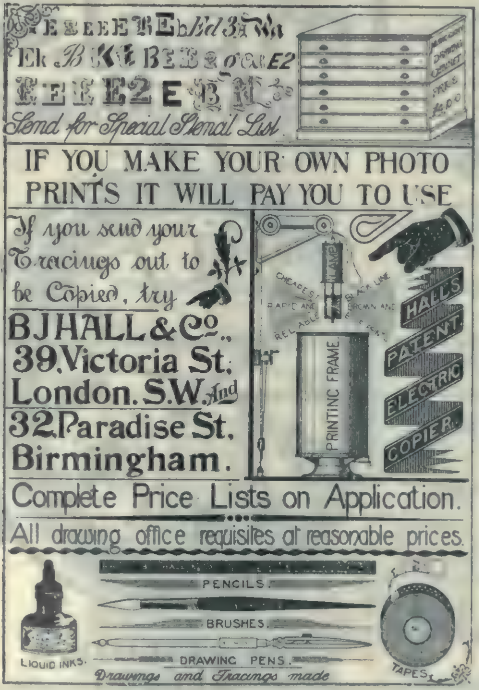


ARTHUR STAFFORD & Co

FINE ART & GENERAL PRINTERS

Illustrated Catalogue & Half Tone Printing A Speciality

DENTON MANCHESTER



Send for Special Stencil List.

IF YOU MAKE YOUR OWN PHOTO PRINTS IT WILL PAY YOU TO USE

If you send your Tracings out to be Copied, try

B J HALL & Co.,
39, Victoria St.,
London. S.W. And
32, Paradise St.,
Birmingham.

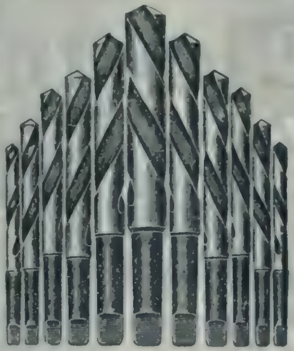
HALL'S PATENT ELECTRIC COPIER.

Complete Price Lists on Application.

All drawing office requisites at reasonable prices.

Drawings and Tracings made

LAMP
CHEAPEST RAPID AND RELIABLE
BLACK LINE BROWN AND
PRINTING FRAME
PENCILS.
BRUSHES.
DRAWING PENS.
LIQUID INKS.
TAPES.



Twist Drills,

Taps,

Milling Cutters,

Reamers.

H. F. SCHNICKE,

CHEMNITZ (Saxony).

THE PHOTOGRAPHING OF MACHINERY, &c.,

IS EXTENSIVELY UNDERTAKEN BY

MESSRS. ELLIOTT & FRY

in any part of the United Kingdom, for which work special terms will be sent on application, distance being no object.

ONLY ADDRESS :—

55, Baker Street, LONDON, W.

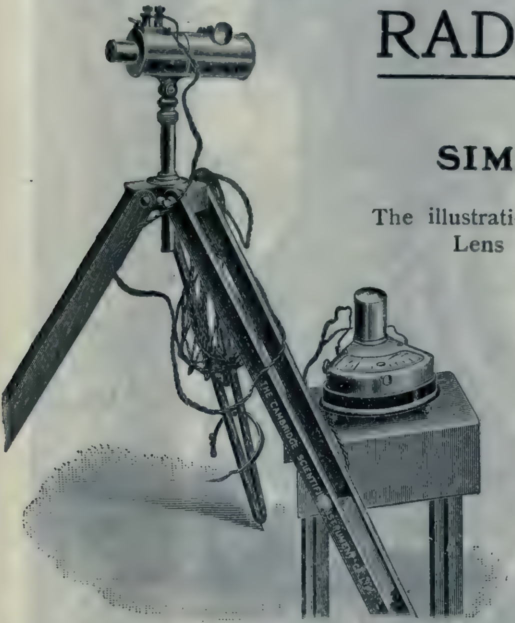
Telegrams:
PHOTICS, LONDON.

Telephone:
293 PADDINGTON.

PAGE'S WEEKLY Engineers' Appliances

A Revolution in Temperature Measurement.

From 500° C. to the
HIGHEST KNOWN
TEMPERATURES.


THE CAMBRIDGE SCIENTIFIC INSTRUMENT CO.

THE FÉRY
RADIATION PYROMETER

IS

SIMPLE, CHEAP, and ACCURATE.

The illustration shows a complete Thermometric Outfit, consisting of Féry Lens Pyrometer and Meylan D'Arsonval Galvanometer, with Tripod Stand and Leads.

Price - - - £20 17 6

Write for List No. 30P, post free.

SOLE AGENTS for United Kingdom, Colonies, and U.S.A.,

THE
Cambridge Scientific Instrument Co. LTD.,
CAMBRIDGE, ENGLAND.

THE "FACILE" TIME-STAMP

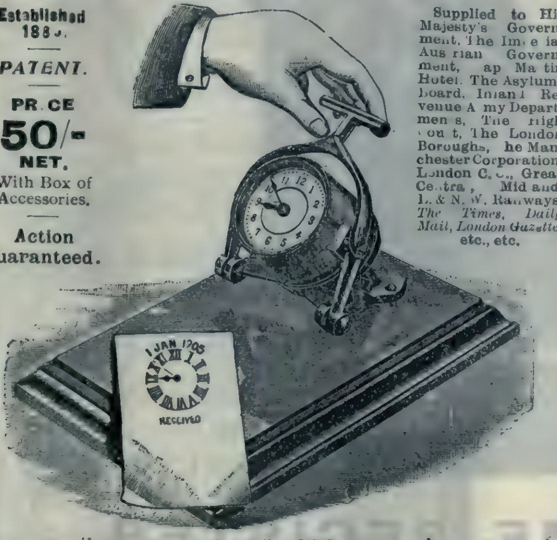
An English Invention. Manufactured in LONDON.

Established 188[illegible].

PATENT.

PRICE
50/-
NET.
With Box of Accessories.

Action Guaranteed.



Supplied to His Majesty's Government, The Imperial Austrian Government, Cap Martin Hotel, The Asylums Board, Inland Revenue, Army Departments, The High Court, The London Boroughs, The Manchester Corporation, London C.C., Great Central, Midland, L. & N. W. Railways, *The Times, Daily Mail, London Gazette*, etc., etc.

It impresses the MINUTE, HOUR, DAY, MONTH, YEAR, and any WORDS in combination, at ONE OPERATION, in an INSTANT. Is self-inking and always ready. A TIME-CHECKER FOR ALL PURPOSES.

Use this Machine to time any transaction, task, race, experiment, or journey. Check the exact moment of receipt or dispatch of Telegrams, Letters, Parcels, Calls, Orders, etc. etc.

Useful in the Office, Warehouse, or Workshop.

WARWICK'S TIME-STAMP CO., 134, Highbury Hill,
LONDON, N.

(the Organ of the British Advertiser Service Bureau) has a special article in its July issue on

HOW ENGINEERS ADVERTISE.

A copy will be sent with pleasure to anyone mentioning PAGE'S WEEKLY.

We are specialists in the preparation of business literature for engineers, our aim *not* being to increase your expenditure, but to make that expenditure more productive.

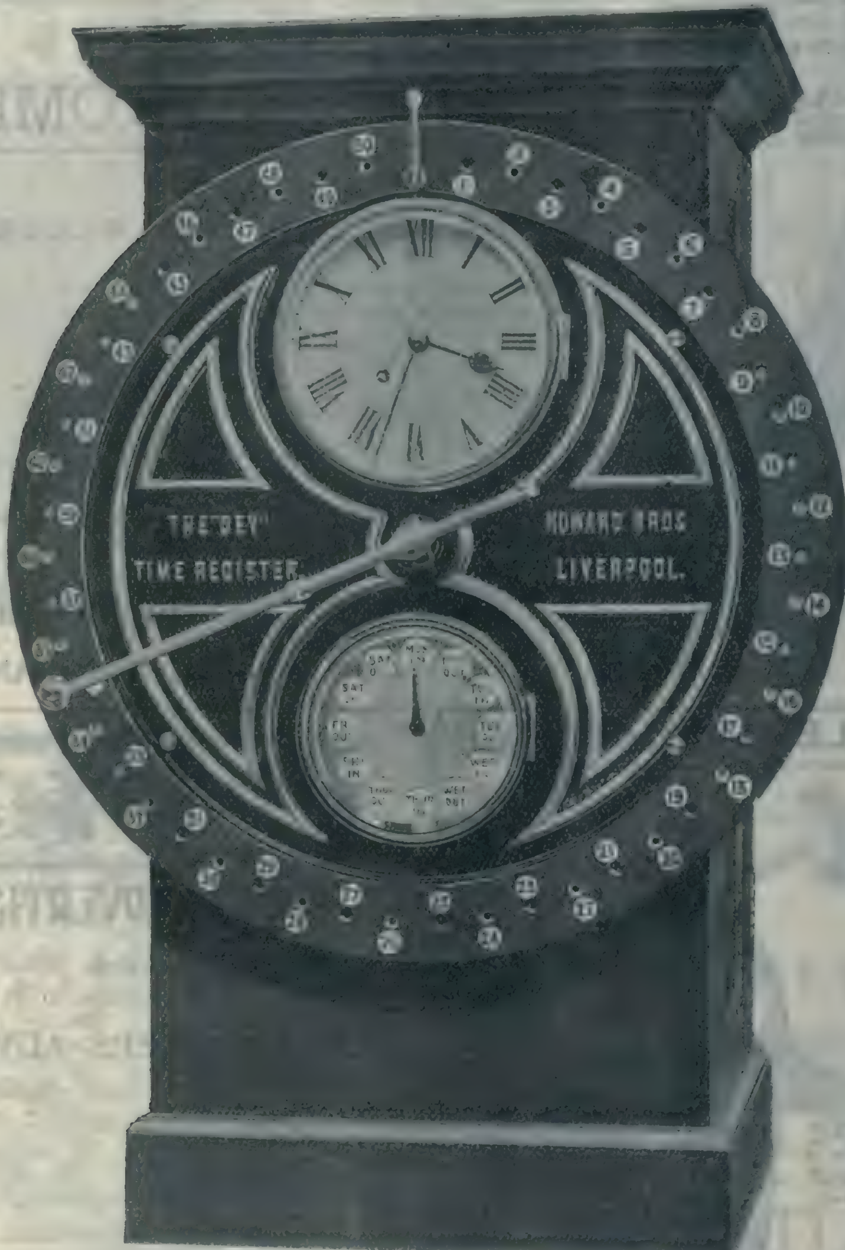
We do not undertake the placing of advertising, but only its preparation.

The British Advertiser Service Bureau,
Queen Anne's Chambers,
Westminster, S.W.

PAGE'S WEEKLY Time Recorders

Indispensable to Employers of Labour.

TIME KEEPING BY WEEKLY TIME SHEETS.



COST KEEPING BY CARDS. (ON SAME MACHINE.)

THE "DEY" TIME REGISTER.

HOWARD BROS., Proprietors and Manufacturers,
100c, Queen Victoria Street, LONDON, E.C.
Head Office: **40, Paradise Street, LIVERPOOL.**

THE PRINCIPAL OF THE FIRM
SPECTEMUR AGENDO
THE FIRM'S PRINCIPLE
Delivery as Promised
THE FIRM'S BUSINESS PRINCIPLE
HIGH CLASS CATALOGUES, CIRCULARS, LOOSE SHEETS &c FOR ENGINEERS.
THE FIRM'S PRINCIPAL BUSINESS

The Firm For Your Firm.

Atlantic Press Ltd.,

ENGINEERS' PRINTERS,

**WEYMOUTH STREET,
MANCHESTER, S.E.**

Telephone: 4774.
Telegrams: "CATALOGUE," Manchester.

MAGNESIA COVERINGS
FOR
STEAM PIPES & BOILERS.

Send for Descriptive Pamphlet to the Sole Manufacturers in Europe.

MAGNESIA PATESIA TRADE MARK COVERING

MAGNESIA COVERINGS, Ltd.,
WASHINGTON STATION
COUNTY DURHAM.

Telegrams: "CHEMICAL," WASHINGTON STATION.
Nat. Telephone: No. 1373 NEWCASTLE.

AGENTS:—

HOBDELL, WAY & CO., LTD.,	63, CRUTCHED FRIARS,	LONDON, E.C.
THOMAS ANDERSON,	53, DERBY ROAD,	LIVERPOOL.
HICKSON'S LTD.,	38, WELL STREET,	BRADFORD.
PETER FERGUSON,	19, ROYAL EXCHANGE SQUARE,	GLASGOW.

W. C. HOLMES & Co.,
ENGINEERS.
Sole Makers of the . .
"WESTERN" DOUBLE
FACED VALVE.

SPECIALITIES:—
ROOFS,
BRIDGES,
GIRDERS,
STRUCTURAL
IRON WORK,
TANKS, &c.

Works—
Huddersfield.

London Office—
11, Victoria
Street, S.W.

Telephone: 2593 (Nat.). Telegrams: "OILWELLS, MANCHESTER."

ESTABLISHED 1860.
Contractors to His Majesty's Government.

For Preserving Bright Machinery from Rust or Corrosion, use

"Crystoleine"

THE BEST AND MOST SATISFACTORY OF ALL ANTI-CORROSIVE COMPOSITIONS.

IS ESPECIALLY SUITABLE TO ENGINEERING FIRMS SENDING MACHINERY ABROAD.

Write for particulars to Sole Manufacturers:—
MATTHEW WELLS & CO.,
HARDMAN STREET OIL WORKS,
MANCHESTER

Sole Manufacturers of the "Wellsaline" Lubricants.

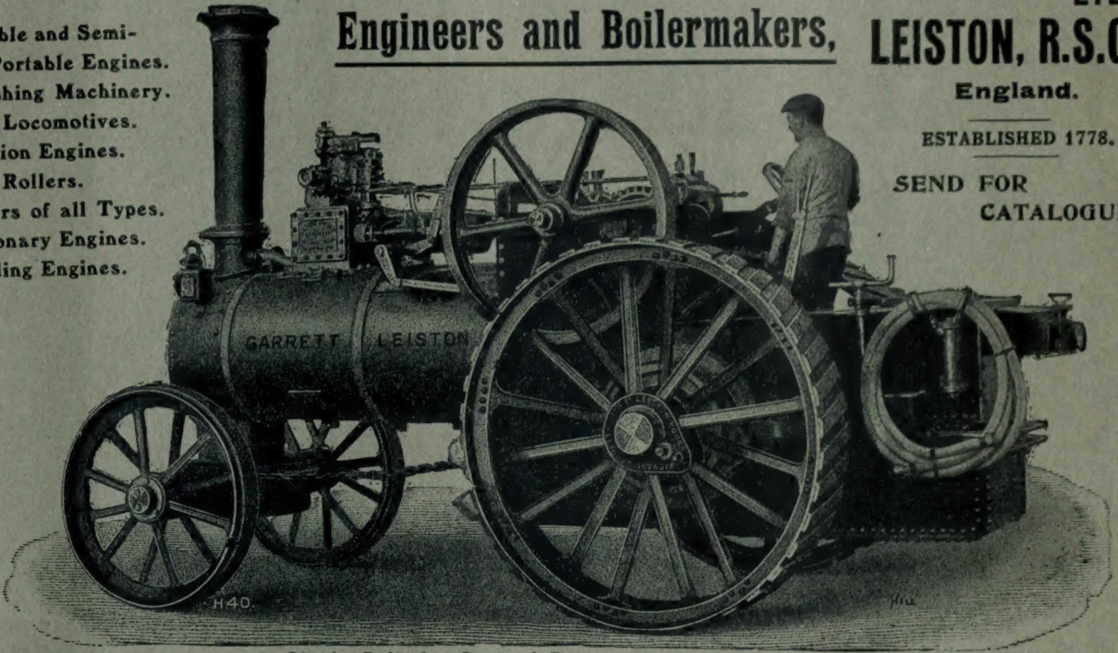
RICHARD GARRETT & SONS,
LTD.,
Engineers and Boilermakers, LEISTON, R.S.O.
England.

ESTABLISHED 1778.

SEND FOR CATALOGUE.

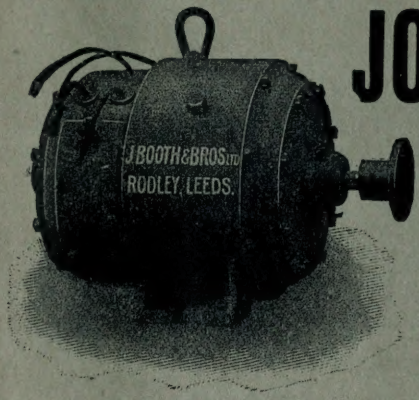
Portable and Semi-Portable Engines.
Threshing Machinery.
Road Locomotives.
Traction Engines.
Road Rollers.
Boilers of all Types.
Stationary Engines.
Winding Engines.

CORRUGATED FIREBOX



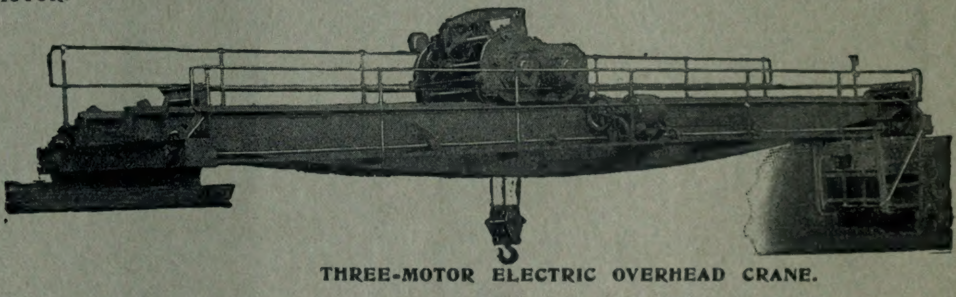
Single Cylinder General Purpose Traction Engine.

JOSEPH BOOTH & BROS.
LTD.,
Electrical and Mechanical Engineers,
Telegrams: "CRANES, RODLEY." Rodley, LEEDS.
Makers of Dynamos, Motors,
Electric & Steam Cranes.



ENCLOSED MOTOR.

Inquiries Solicited.

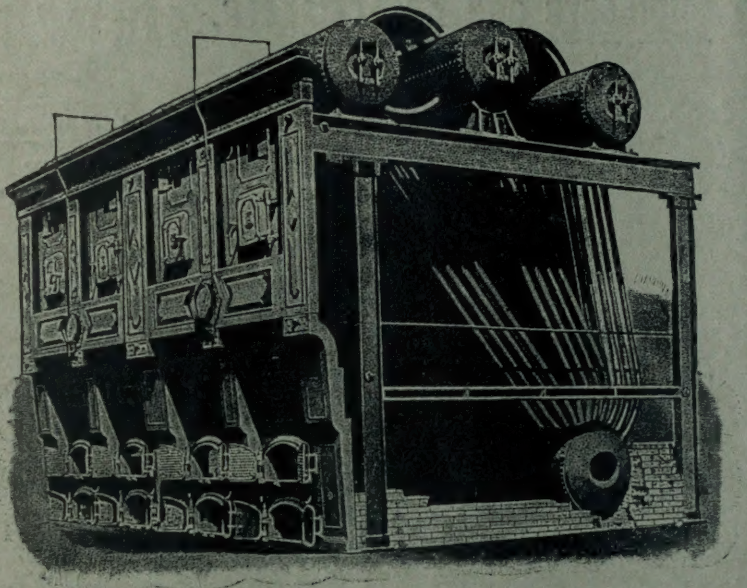


THREE-MOTOR ELECTRIC OVERHEAD CRANE.

Cranes. Capstans. Winding Machines.

Makers to Home, Colonial, and Foreign Governments, and all Leading Firms.

THE STIRLING BOILER CO.,
LIMITED.



Head Office and Works :—
MOTHERWELL, N.B.

Smokeless
Combustion
Guaranteed.

LOW GRADE
COAL.

CHAIN GRATE
STOKERS.

London Office:
25, Victoria St.,
Westminster, S.W.

CONTRACTORS TO HIS MAJESTY'S AND OTHER GOVERNMENTS.

JAMES FAIRLEY & SONS,

General Steel Manufacturers,
and SPECIALISTS in . . . **TOOL STEELS**

Invite attention to their Unrivalled Self-hardening Steel.

FAIRLEY'S SELF-HARDENING TOOL STEEL

FOR HEAVY CUTS AT HIGH SPEEDS.

Is considered to be the HARDEST and TOUGHEST Steel yet made (although the cheapest in the Market). Small samples free to approved buyers.

NOTE.—JAMES FAIRLEY & SONS' WORKS (Bramall Lane, Sheffield, and Mill Street Forge and Rolling Mills, Birmingham) are merely Branch Departments, and

All Communications should be addressed to the Head Offices :—
OLD MINT, SHADWELL STREET, BIRMINGHAM.

John Purden & Sons,
LAMBHILL FORGE,
BY MARYHILL,
GLASGOW.

On Admiralty List.

Makers of Marine and other Forgings, rough turned or finished. Tail-End Shafts, Built Rudders and Crank Shafts finished complete.

Telegrams: "FORGINGS, GLASGOW."
National Telephone: No. 34 MARYHILL.

Printed for the Proprietors by SOUTHWOOD, SMITH & CO., LIMITED, 6, 7, 8, 9, Plough Court, Fetter Lane, London, E.C.; and Published at Clun House, Surrey Street, Strand, London, W.C.